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THE FOUNDRY

Cleveland Convention Daily

EXTRA! For four days, starting Monday, May 12, THE FOUNDRY will publish the *Cleveland Convention Daily*, giving spot news of the convention activities just a few hours after they happen. This full size newspaper will be distributed free to all visitors at the convention and exhibition, and also will be mailed with the compliments of the American Foundrymen's association to the homes of all of its members.

During the week of the convention, the entire facilities of the Penton Publishing Co. will be held in readiness for the demands that may arise in the preparation of the *Cleveland Convention Daily*. All during the convention, the staff of THE FOUNDRY will be busy collecting the news events of the day, and rushing the copy to the Penton building in time to make the edition. Editors will attend the technical meetings to report the important discussions which will develop in that phase of the convention. Other members of the staff will cover the exhibition with its many attractions, the entertainment features which have been planned for the convention week, the plant visitation trips, and every activity of the busy week. Various leaders in the industry will express their views on business trends in various sections of the country.

Each day's newspaper will contain complete advance information on the various activities of the day. This will be the only source for obtaining this complete information in one publication. Each day's edition will be delivered at the convention and the technical meetings. Watch for

THE FOUNDRY

Cleveland Convention Daily

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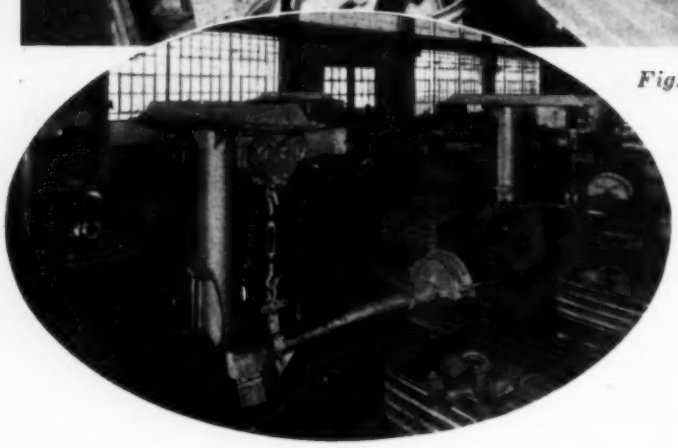


Fig. 1—(Above)—Preliminary Repair Department. Fig. 2—(Left)—Swing Frame Grinders

Steel Shop Cleaning

THE bottle neck in many steel foundries is the cleaning department. This was the situation at Eastern Steel Castings Inc., Newark, N. J., some years ago, but through the installation of conveyors and new equipment and the adoption of a piece rate and bonus system of compensation, the company has been able to cut its previous cleaning costs more than one half. Cleaning operations have been speeded up to such an extent that work reaching the shakeout one day is in the shipping room the second day following.

The cleaning department embodies the fullest use of roller conveyors for the transporting of castings from one operation to another. While conveyors are used extensively throughout the foundry those employed in the cleaning department extend from the shakeout to the shipping department and back to the shakeout. The arrangement of conveyors may be likened somewhat to a railroad system with its main line and its sidings. The main line conveyors are crossed at right angles at frequent intervals by side lines which take work from the main line to process equipment, and then deliver it back to the main

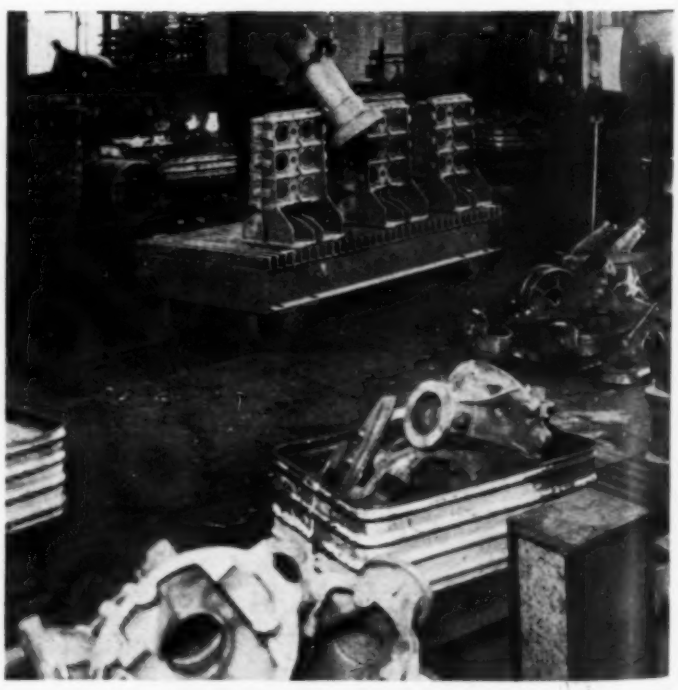


Fig. 3—Small Castings Are Ground on Stand Gri

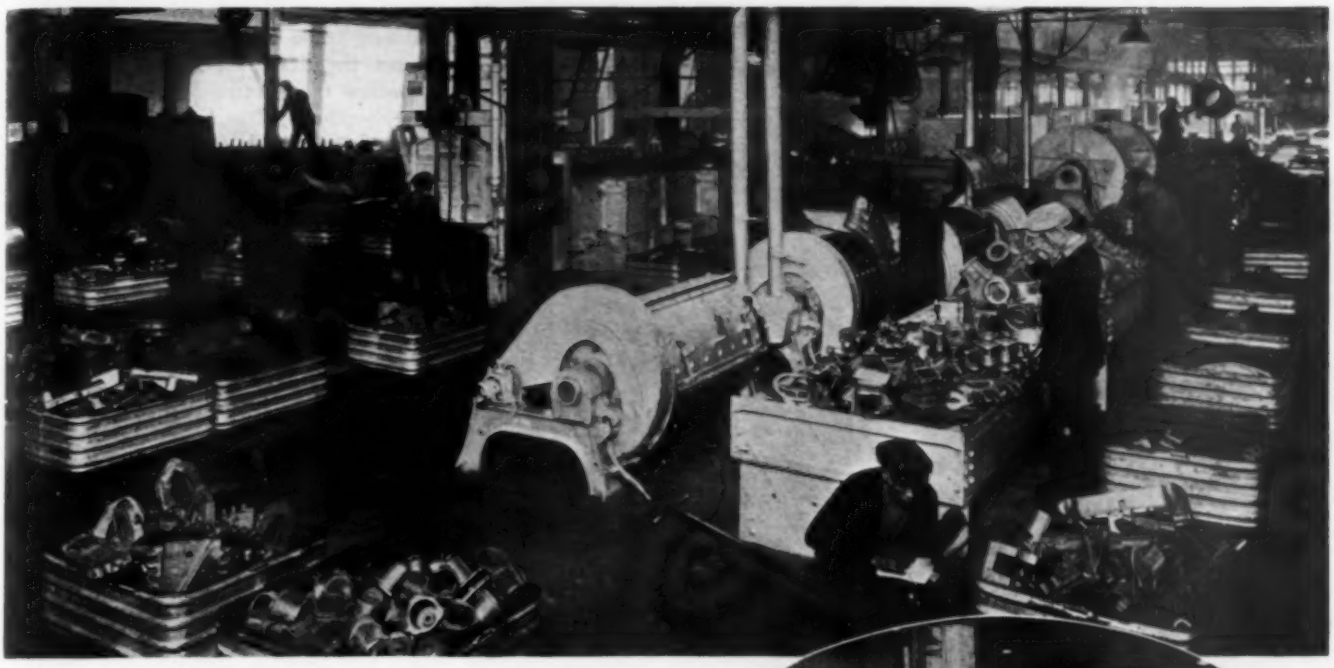


Fig. 4—(Above)—Tumbling and Inspection of Castings. Fig. 5—(Right)—Sandblasting the Castings

REDUCES Costs

By Herbert R. Simonds

nders and Large Work on Swing Frame Units

line or else direct it to a succeeding process. The path of castings from the shakeout through the cleaning department has been laid out after much careful study so as to avoid all unnecessary back movement. Castings which pass inspection and thus need no repairs move steadily forward through the sandblast, grinding, chipping and sorting operations to the shipping department.

The shakeout which is the starting point for cleaning processes is a raised vibrating grating inclined to the horizontal so that the castings almost slide off of their own accord. The height of the grating is such that the front or lower side comes just above steel boxes standing on roller conveyors ready to receive the castings. The method at this point is clearly shown in Fig. 7. Two men at the shakeout handle the full plant production which ranges from 90 to 110 tons a week for one shift operation.

One of the features contributing to the successful operation of the cleaning department is the sorting and separation of castings. This starts back on the molding floor where castings of one particular type are poured at one location and held as far as possible as a unit in delivery to the

Fig. 6—(Above)—General View of the Cleaning Department

shakeout. This means that instead of having all grades of castings on the shakeout at one time, large castings are handled almost exclusively for a time and then smaller castings follow. Of course it is impossible to draw any sharp line at this point, but the management has found that a marked difference in classification at the shakeout may be secured without interfering in any way with the efficiency of molding or of transporting from the molding floor to the shakeout.

A further selection takes place at the shakeout where castings of one variety are placed together in the steel boxes as far as possible. The section of conveyor which passes in front of the shakeout is known as the shakeout loop. From the shakeout the boxes filled with castings travel by gravity on roller conveyors to the sandblast. The system of conveyors is continuous to and from the shipping department and the empty boxes at the shipping department are elevated so that they travel by gravity back to the shakeout loop. The conveyor design will be described in greater detail later. Briefly, the conveyors consist of lines of parallel rollers each 20 inches long, supported about 12 inches above the floor. The height varies at times to secure gravity propulsion.

The distance from the shakeout to the sandblast is sufficient to allow the castings to cool on the way and thus permit the first inspection immediately before the castings enter the sandblast section. The inspectors at this point are paid a bonus based on the percentage of defective castings detected. However, the bonus is not operative unless they detect at least three-quarters of the plant's total percentage of defectives. This is thought to be an unusual inspection service. The castings in the phrase of the shop are "in the green," and the detecting of so large a proportion of defects while the heads and gates are still on is a big labor saving process, as the cleaning labor of the defective castings thus is entirely eliminated.

The small castings pass to a sprue cutter where the heads and gates are removed before they enter the sandblast. Heads and gates of all castings are thrown directly into charging boxes which are transported by conveyor and then elevator to the charging floor. The large castings go to the sandblast tables after the first inspection while the small castings have a second inspection after leaving the sprue cutters. The inspection tables are built to bridge over the conveyors. This scheme helps to economize space and also cuts down the handling of the castings by the inspec-

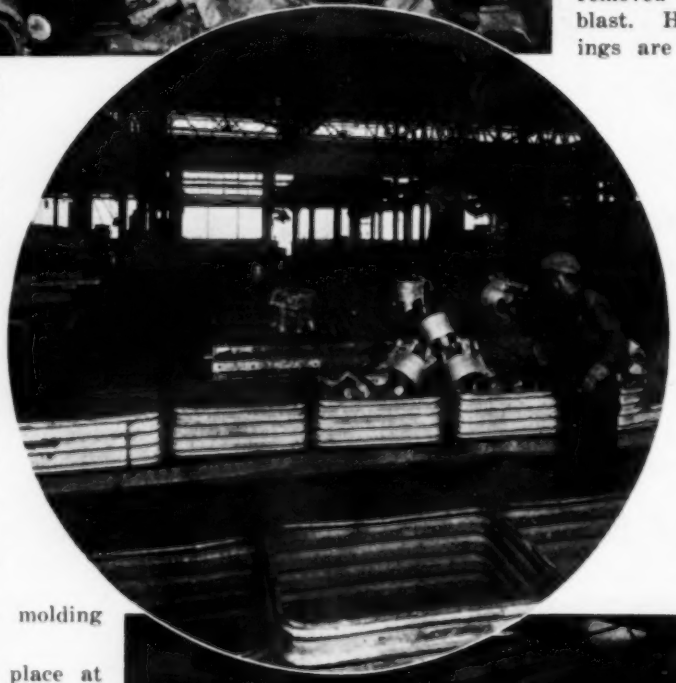


Fig. 7—(Left)—The Shakeout. Fig. 8—(Below)—Secondary Repair Department

tors. From the sandblast the larger castings go to a scale where they are weighed in to the burn off section. The burn off men using oxyacetylene torches have every possible convenience and the castings are lined up for them on slotted benches. They are paid on a tonnage basis with a premium based on saving of gas. On certain work the burn off men receive a second premium based inversely on the amount of metal removed by the grinders in the succeeding operations. In other words, if the burn off men can come close to the specified finish surface and thus reduce the amount of grinding required they receive half of the saving which the close work that they do makes possible.

After burning, as indeed after nearly every operation, there is a further classification. That is, pieces of a type are thrown into one box as far as possible. From the burn off section the pieces are weighed out and this same weight becomes the weighing in figure for the grinding department. Small castings travel on the conveyors to the floor stand grinding section, while the larger castings go to the special swing grinders which are centrally located. These grinders, shown in Fig. 2, which were designed by the company are claimed to be exceedingly fast and efficient. The

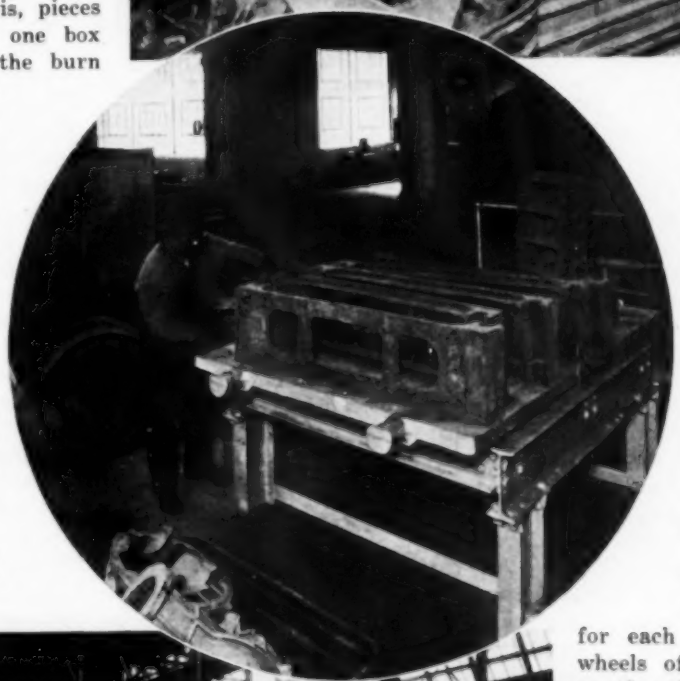


Fig. 10 (Left)—An Inspection Table. Fig. 11 (Above) Removing Gates and Heads

Fig. 9—(Below)—Special Benches Are Provided for the Chippers

grinding wheel, as may be seen, is directly connected to a motor which puts it at right angles to the line of vision of the operator in his natural position. Thus the operator instead of doing his work by a back and forward motion, grinds by a side motion. The grinding speed of the wheels is kept as near uniform as possible at approximately 9500 surface feet a minute. This is done by arranging the grinders in three groups with a different motor speed for each group. The new grinding wheels of large diameter are placed on the slow motor machines and as the wheels wear down they are moved first to the intermediate speed motors and then to the high speed motors.

A convenient foot operated hydraulic vise has been designed for holding the castings on the low benches while using the swing grinders. The swing grinder stands have been designed for two grinders one on each side but only one is normally in use. This particular feature follows the company's plan for the whole department which is to have sufficient elasticity of equipment and space for greatly increasing the capacity. The management states that the production of the cleaning department could be increased by 200 per cent almost overnight. At present the average time of a casting in the cleaning department is two days

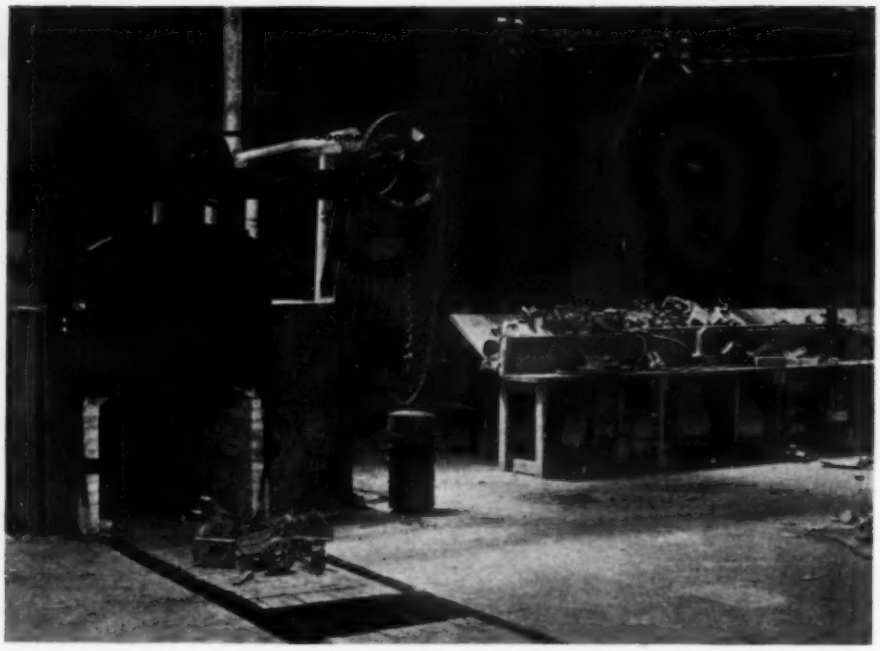


Fig. 12—Cleaning Department and Annealing Furnace Before the Reorganization. Compare with Same Department Shown in Fig. 4

or less, whereas under the old scheme of cleaning it frequently took three weeks to get a casting from the shakeout to the shipping department and the average time was not much under this. In the grinding department the operator's pay is based on the amount of metal removed. This amount is determined by subtracting the weighing out tickets from the weighing in tickets.

From the grinding department the castings are transported to the chipping section. The chippers are provided with solid concrete benches with wood block tops. These benches are of double width with a partition running between. The chippers stand along one side and put the work over the partition as they finish it. The castings are then inspected on the other half of the bench. This is the fourth inspection. If repairs are needed the castings are marked with chalk to indicate the nature of the repairs and are then sent either to the electric or to the oxyacetylene welders. The welders have special enclosures provided with revolving tables. New work is placed on one side of table while work on the other side is being welded. The enclosures are without top and bottom permitting a free circulation of air. Castings at this point which pass inspection are sent to the annealing furnaces.

All castings are annealed on car type annealers. The operation following annealing is tumbling and then follows in sequence an additional classification, the fifth inspection and finally weighing as they leave the cleaning department and enter the shipping department. This final weighing gives the output of the cleaning department and the figure may be compared each day with the weight at the first scale which gives the tonnage entering the department.

Fig. 13—Castings Are Tested for Surface Alignment and Are Straightened in a Hydraulic Press

The shipping department is a large airy space with wood block floor and the handling here is done almost entirely by lift truck. The orders are made up as shown in Fig. 9 direct to lift truck boxes. These are then picked up and carried either to motor trucks or railway cars for shipping.

Castings which do not pass the fifth inspections go to a secondary repair department which is virtually a duplication on a small scale of the first repair department. Adjoining this secondary repair is a hydraulic press department for straightening castings.

The type of roller conveyor used is one developed primarily for handling green sand molds, but which has been found advantageous in the cleaning department as well. The conveyors are built in uniform sections 5 and 10 feet long and are interchangeable. The frames are made of rolled steel angles and bars welded together. The rollers are cold drawn seamless tubing cut into 20-inch lengths.

These pieces are machined on the inner surface at each end to receive the ball bearings and the bearings in turn are supported on ¾-inch cold rolled shafts. The device for fastening the roller assembly to the frame is such that a roller may be changed readily. Integral with the bearing case is a sand seal which excludes sand and grit and at the same time facilitates the retention of grease with which the bearing is packed. The lubricating system is such that the conveyors do not need attention for a period of two years or more after installation.

An important feature of any roller conveyor system for a foundry is the design of runners for the bottom of the boxes or boards which are to travel on it. Metal runners or battens are used throughout the Eastern Steel Casting plant and their accuracy is as important as the accuracy in the conveyor itself. The switches are made with small rollers set between rows of the full size rollers. The top surface of the small rollers is normally below that of the others, but where switching is desired a foot pedal raises them up above the large rollers permitting the box to be pushed at right angles to its line of travel on to the side conveyor.

American Brass Foundry Practice

By Charles Vickers

Part VII—Laying Out the Patterns

THE jobbing brass foundryman only occasionally controls the arrangement of the patterns from which he is expected to make castings either by machine molding or from gated patterns. He must subscribe to the ideas of someone else as to how they should be made, regardless of whether they happen to be right or wrong as measured by his own experience. Some customers are noted for the crudity of their pattern equipment and others for the excellence of theirs. This difference is of high importance to the one who is to make the castings, as it may mean the difference between profit and loss on the job. However, this matter too often is lost sight of in eagerness to land the contract, especially if it appears to be a desirable one.

Consider Pattern Equipment

It is one of those little preliminaries that is considered carefully beforehand by the successful founders. Others, if they consider the business warrants it, will go to the expense of making their own plates or gated patterns. When this hardly is justified they will make whatever changes they think necessary on the patterns furnished, using plastic wood, or composite modelling clay as the case may require. The latter substance is convenient for putting in fillets, etc., but the plastic wood has to be used judiciously. Otherwise it may be difficult if not impossible to remove it when the patterns are *called in*, to be sent away to some lower-priced competitor.

Poor patterns, or poorly arranged patterns, whether on plate or gate, produce more costly castings than well arranged and well designed patterns. The purchaser of castings is not the only offender in the matter of cheap work, made by cheap men. Some foundrymen are just as bad and because of defective pattern equipment go on year after year throwing money away with their runs of *bad luck*. This is because they cannot be made to see the great need for a complete overhauling and redesigning of their antiquated pattern equipment by someone who knows how to go about the job. However, such foundrymen will spend money on things not quite so necessary. In one case of an old established business, new and efficient electric equipment was installed. Yet the dryers do not fit the cores, the cores do not fit the prints in the molds, the methods of gating are radically wrong, and losses run high in consequence.

Plates, gates and white metal patterns after 50 years service are not the same as when they were new and shiny. They are entitled to retirement after long and honorable service. They do not all have to be retired at once for metal pattern-making is expensive work and large sums can be invested in such equipment. However, it does not cost any large amount to get the opinion of a metal pattern expert in such matters. Then a plan can be formulated for a gradual retirement and replacement, starting with the worst examples first, and possibly covering a period of years.

Methods Vary Greatly

It can be observed frequently that the methods of gating small castings vary greatly, not only in the case of different shops, but in the same shop, and on the same gate or plate of patterns. In fact it does not appear to matter greatly how the patterns are arranged with respect to the inflow of the metal to produce castings. Thus as shown at *A*, Fig. 11, twelve of the patterns are ar-

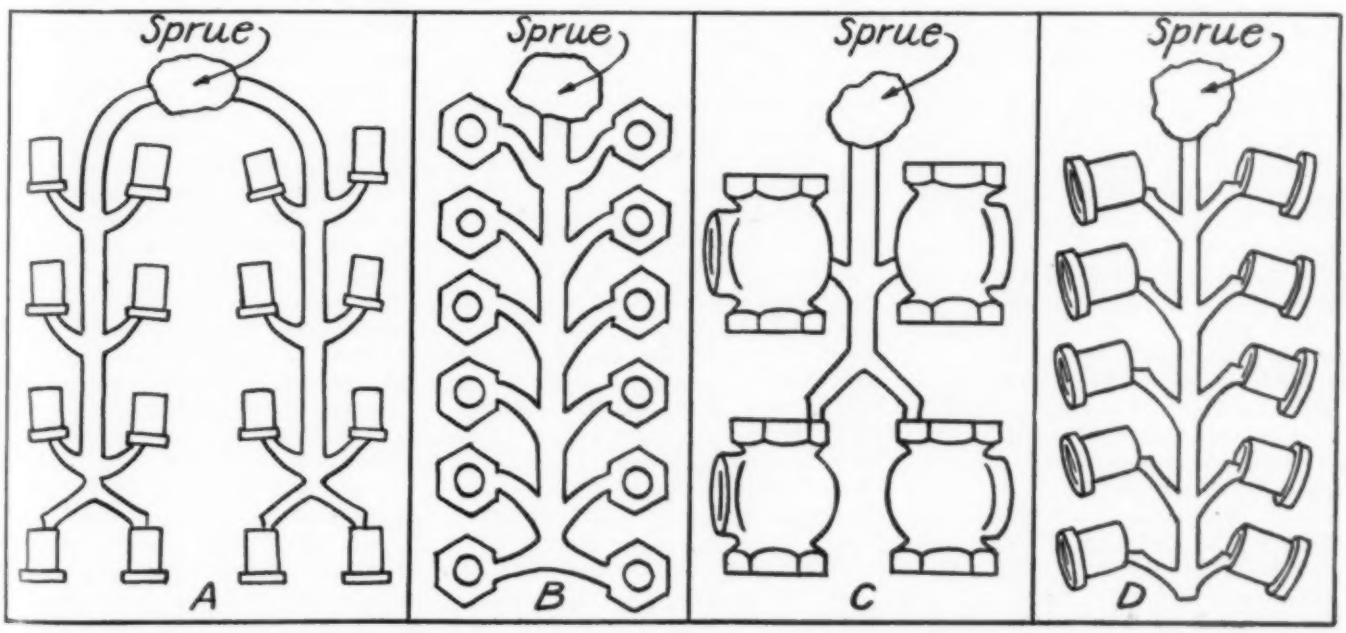


FIG. 11—*A* SHOWS GATE OF ½-INCH UNION SWIVELS. *B* SHOWS GATE OF ½-INCH EXTRA HEAVY UNION NUTS. *C* IS GATE OF 2-INCH GLOBE VALVE BODIES, AND *D* IS A GATE OF ¾-INCH UNION SWIVELS

ranged on the plate in conformity with some vague idea that it was best to have the brass flow uphill, as these castings were poured on an incline with the sprue highest. Yet there was evidently a change of mind when it came to the patterns farthest from the sprue. It did not appear to make any difference how these were gated, so the metal is caused to shoot straight into the mold cavities.

The twelve patterns are arranged ideally so that the eutectic can be drained from the castings by the gate and runner. The same applies to the gate of nuts at *B*, Fig. 11, although in the latter case it probably does not make much difference how the patterns are arranged as far as drainage of eutectic goes. At *C*, Fig. 11, a gate of 2-inch globe valve bodies is shown where two of the patterns are gated on the hexagonal part, and two on the center of the body where the metal is thinnest. At *D*, another gate of swivels like those at A, but larger and gated in a much better manner is shown. All these patterns were on plates for machine molding, and it is difficult to account for the difference between *A*, and *D*, in arranging and gating the patterns. This difference in the arrangement of small patterns on plates often is not noticed in the foundry and is the cause of many perplexing situations.

High Leaker Loss

In one foundry there were two plates of waste cocks of exactly the same shape. One was slightly larger than the other and never gave the least trouble. The loss due to leakage or anything else being below normal if anything. The other plate was known as a jonah. No molder liked to work on it, as it meant contiual trouble, in the shape of a maximum of leakers. The strange thing is that no one ever thought of comparing the two plates side by side. When this was done the reason for having trouble with the one was apparent. The longitudinal runner had been placed on the drag side of the plate, while the branch gates were in the cope, where they could hold the eutectic in the castings. The one in the drag drained the eutectic from the casting by gravity because it was situated at a lower level than the gates into the casting. When the change was made there was no difference in the working of either plate.

Fig. 12 illustrates another method of gating globe valve bodies, with the gates to the castings a little exaggerated to illustrate the subject better. The castings are supposed to be resting in the drag half of the mold after the cope has been lifted away, and the loose sand swept off When loss occurred from leakage of the valves, it was always the end nearest the sprue that was affected as the molds were poured on a slight incline. The late Erwin S. Sperry commenting on a similar occurrence, attributed the leakage of the bodies to oxidation of the metal due to pouring to cool. While this undoubtedly influenced the defect,

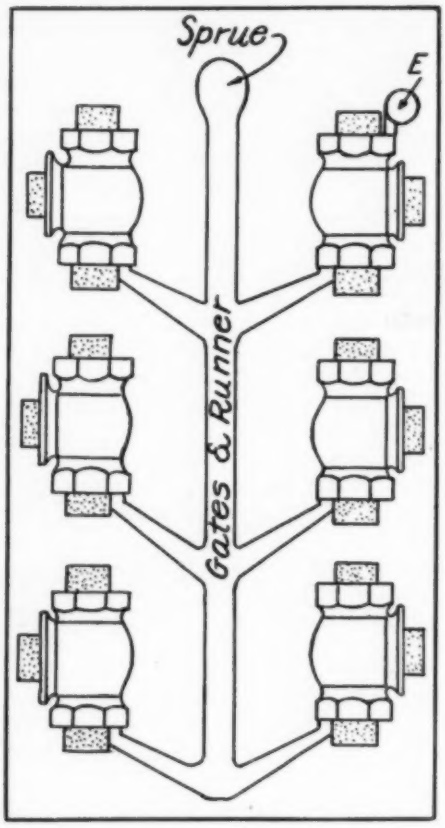


FIG. 12—CASTINGS NEAREST THE SPRUE WERE LEAKERS

it could not have been the entire cause, otherwise the leaks would have appeared elsewhere on the castings than adjacent to the gate. Oxide particles are likely to be carried anywhere, while the eutectic that is bled from the castings by the gates, naturally would be in the vicinity of the same.

It might be supposed that the upper part of the valve adjacent to the hexagonal end of the valve body also would bleed down and that also would provide leaks. However, a moment's reflection will show that the comparatively heavy hexagonal portion at the highest point would feed the thin neck immediately below and induce solidity. The small amount of eutectic thus absorbed from the hexagonal part would not be missed as it would be taken from the central part. However, in the case of alloys having more than the normal internal shrinkage, or that were poured too cool there might be sufficient drainage in the upper hexagonal portion to be revealed as an open crack when the internal threads were cut on the casting. This would call for a shrink ball as at *E*, Fig. 12.

In the case of the heavier valves having flanged ends, it is often necessary to put risers on top of the flanges to prevent leakage at the juncture of valve and body. Leakage is caused usually by hair cracks between the body and the flange resulting from shrinkage of the metal. The flanges are held firmly in place by the mold and cannot come together so are separated from the body creating invisible cracks through which steam, gases, or liquids under pressure find an easy pathway.

These cracks often can be traced to a wrong design of the valve body, in that the body is too thin in proportion to the weight of the flanges. It sets far in advance of the flanges and pulls away from them. Risers on the flanges will not help this condition. The pattern has to be redesigned with a heavier wall thickness to the body, and a more gradual curve of the fillets. Sometimes in this case also the leakage is due to eutectic drainage by the lower part of the flanges from the part joining the body. Risers on top of the flange are used to prevent this fault.

Need Right Type of Alloy

There is also a considerable difference in the alloys used for such castings, as some shrink more than others and crack easily. When a composition metal is used for valve bodies with heavy flanges there will be more trouble with an ingot carrying antimony, bismuth, etc. than with alloys made of metals free of these elements. These impurities render the metal red short, so that it cracks easily. When the metal used is new or virgin as it is called, the constituent to be scrutinized closely is the copper as it forms the base of the alloy. Not all copper is the same, but no great effort is required to get the proper brand to use and that brand is not made from secondary copper, but electrolytic of high grade.

Sometimes, and not unfrequently the purchaser of valve castings, or of complete valves for special purposes not only decides the shape the patterns shall take, and makes the mistake of getting the body part too thin, but also makes rigid specifications regarding the alloy consequently, every foundryman trying to supply castings has to go through an expensive apprenticeship before his efforts are crowned with anything near success. Even later his losses due to rejects are higher than would be necessary

if either the pattern was designed for that particular alloy, or the latter was changed to avoid unnecessary troubles in the foundry.

For example a certain valve alloy supposedly designed to resist high steam pressures has a base of copper with 25 per cent of nickel, considerable zinc, and smaller additions of lead, tin and above all iron. This makes a jumble of ferrous and nonferrous metals entirely unnecessary as far as the ferrous part is concerned. Every foundryman knows that an alloy of copper, zinc and nickel is a combination filled with potential trouble without having anything else added to it. However, a little lead to aid machining, and a little tin for stiffening purposes usually are worked in and to no harm.

Iron Causes Trouble

Why include the iron? What good is that except to make trouble, and cause loss for the suffering brass founder? Iron is added in small amounts 0.5 per cent in certain German silver alloys for rolling purposes, to whiten the alloy and stiffen it, but we are cautioned by Wood in his *Waterbury Book of Alloys*, about using too much as it will segregate as nodules. Nodules of free iron in a casting for acid resistance do much harm as they form points for easy attack by acid waters, and once the acid penetrates the metal the efficiency of the latter is over.

Iron can be alloyed with copper in the presence of aluminum, because the latter metal decarburizes the iron and causes it to go into solution with the three metals. Iron is a distinct advantage in aluminum bronzes, and it has its usefulness also in manganese bronze and other alloys of that type high in zinc, and sometimes containing aluminum. In the case of any copper alloy, or copper-nickel alloy that does not contain aluminum, iron is a detriment, not only to the alloy itself, but to the making of castings. It greatly increases the cost, because of unnecessary defects in the castings.

These unnecessary defects are not only segrated iron. Iron is found in composition metals in three states: (a) As free iron, which separates as nodules; (b) as combined iron, and (c) as iron sulphide. Separated iron has been known for years probably to greater extent by the machinist than the foundryman, although when much of the machinist's time is spent sharpening tools the foundryman quickly hears about it. The reason iron exists as nodules is that it is combined with carbon for which copper has no affinity. Copper will not take up more than a slight amount of carbon and iron. Accordingly the combination is rejected to float around in its own independent fashion. If it does not lodge in some place where the machinist has to use his tools, it does no harm, as long as the castings come out with the desired orange color.

In the case of combined iron, the brass is deoxidized and densified, but the castings come out dark colored. The dark color condemns them in the eyes of the valve maker, for he wants the orange color. Iron sulphide causes most of the trouble. In the copper-nickel alloys containing iron, a considerable amount of sulphide is formed, and this forms the well known *slag spots*. In red brasses it gets the molder into trouble, attributed to be sand from the mold, or sand washed from the core. Where it has washed from, nobody can find out.

These spots have been causing trouble in brass foundries for a century and probably longer. Favorite resting places are under the core, or right near the gate, and it can be spotted along the upper side of the runner like the pits, but dark in color. Iron sulphide is most insidious in getting into castings. Its specific gravity is 4.84 against nearly 9.0 for copper. Therefore it rides high in the pot or ladle. Its melting point is 2187 degrees Fahr., so it is fluid at the ordinary pouring temperature of brass and enters the mold with the first of the metal. Iron sulphide is found in relatively large amounts in the copper-nickel alloy mentioned. Therefore, iron should be eliminated from this alloy and replaced with the same amount of nickel.

Understand Solidification

As has been stated before, and cannot be mentioned too often, the metal patternmaker who lays out patterns on gates or on plates for quantity production should have a pretty good idea of how metals solidify. He should know that first they form crystals which usually have spaces between them that must be filled up later by the constituent of the alloy with the lowest melting point, which is the last to solidify. In other words metallic crystals do not fit together like the cells of a honeycomb, because, while they may be formed regularly, they are orientated differently. When examined under the miscroscope, the crystals present an irregular appearance.

The eutectic generally is extremely fluid and can seep through the spaces from crystal to crystal. It finally comes to rest at the lowest point containing vacancies, and from that point rises to higher levels until it is all spent. If that happens before the crystals in the casting are sealed, the castings will leak under pressures at such points. If the eutectic either drains away from the casting or is insufficient to fill any and all spaces between the crystals, a pathway is left between the nontouching faces of the crystals, through which gases and liquids may be forced by a slight pressure.

This subject is of major importance to founders who specialize on small castings, such as those in everyday use in our homes and public buildings, for if they leak they must be scrapped no matter how much finishing work has been done on them before they were tested. So prevalent are leaky castings that few manufacturers of such contrivances as faucets will take a chance on doing more machine work on them than necessary before testing them for *leaks*. All the leaks are not the fault of the metal or the furnace tender for there are other sources of such losses. The least trace of aluminum is bound to jump the loss from leakage from a nuisance to a menace, so no matter how optimistic the salesmen of red brass ingot contaminated with aluminum may be, *never* use it for pressure castings.

Add Nickel to Alloy

In the case of castings carrying steam pressures it has become customary to add a small amount of nickel. Such castings as radiator valves are benefited by the nickel. The addition may be from under 1 per cent to 1 or 2 per cent, as decided by experience in the case. It usually requires a little cutting and trying to get the correct amount.

The value of a small amount of phosphorus in controlling leaky castings has been demonstrated time and again. It is rare to find a maker of small castings that must hold even medium pressures that does not use it. In red brass mixtures the amount added may vary with the percentage of zinc in the alloy. Those alloys running over 15 per cent zinc rarely require more than 1 ounce of phosphor copper containing 15 per cent of phosphorus to 100 pounds of brass. In rare cases 1½ ounces may be added to the metal in the ladle when it is melted in electric or oil-fired noncrucible furnaces.

Experience has shown that even the regular yellow brasses containing up to 26 per cent zinc, 2 per cent tin, and 3 per cent lead are benefited in their pressure-resisting qualities by the addition of a small amount of phosphor-copper. About ½ ounce of phosphor-copper per 100 pounds of

(*Continued on Page* 83)

Regional Meeting
Attracts Midwestern Foundrymen

Joint Convention of American Foundrymen's Association and Quad City Foundrymen's Association Held at Moline

MORE than three hundred foundrymen and those connected with the equipment and supply firms identified with the industry participated in the first regional meeting of the American Foundrymen's association, held in co-operation with the Quad City Foundrymen's association in Moline, Ill., March 26. These men represented 148 different firms covering a territory ranging from Central Wisconsin to Southern Illinois, and from Central Missouri and Iowa to Indiana. Registration, under supervision of Miss J. Reininga, assistant secretary of the American Foundrymen's association, and plant visitation to 17 of the 40 foundry plants in the Quad city area featured the morning activities.

A novel application of the increasingly popular round table form of luncheon meeting attracted an attendance of 365 men, who were divided into seven groups as follows:

Steel Foundry Practice, H. P. Evans, Hubbard Steel Foundry Co., East Chicago, Ind., chairman.

Malleable Foundry Practice, P. C. DeBruyne, Moline Malleable Iron Co., St. Charles, Ill., chairman.

High Test Cast Iron, F. B. Coyle, International Nickel Co., New York, chairman.

Nonferrous Foundry Practice, R. R. Monroe, Des Moines Foundry & Machine Co., Des Moines, Iowa, chairman.

Gating and Risering, E. W. Smith, Crane Co., Chicago, chairman.

Foundry Costs, C. E. Mitchell, Gray Iron institute, Cleveland, chairman.

Apprentice Training, C. J. Freund, Falk Corp., Milwaukee, chairman.

These sessions, which were introduced by F. W. Kirby, John Deere Spreader Works, Moline, president of the Quad city group, and which were arranged by A. E. Hageboeck, Frank Foundries Corp., Moline, attracted keen interest. At the high test iron round table, Chairman Coyle traced the history of higher physical properties in gray iron. He noted the suggestion made by a subcommittee of the American Society for Testing Materials at Detroit during the week of March 16 that instead of the term *high test*, gray iron should be classified in several ranges, probably on the basis of 32,000 to 40,000; 40,000 to 50,000; 50,000 to 60,000 pounds per square inch and the remaining classification to cover all material having a tensile strength above 60,000 pounds per square inch. He stated that it is possible to make gray iron with a strength of 110,000 pounds per square inch on an experimental basis.

R. F. Harrington, Hunt-Spiller Mfg. Corp., Boston, traced the development of air furnace gray iron at his plant, from the time when small 10-ton furnaces made the first 30,000-pound iron until the time that 40-ton fur-

naces regularly produce iron above 40,000 pounds per square inch in tensile strength. Others participated in the discussion, including W. J. Grede, Liberty Foundry Co., Milwaukee; G. A. T. Long, Pickands Brown & Co., Chicago, and Hyman Bornstein, Deere & Co., Moline.

In the round table on gating and risering, Eugene Smith referred to the meager data on the proper placing and relation of size and height in gating castings. A common error provides gates which are too large, resulting in air currents and tearing action on the sand as the metal enters. Risers frequently are used when they might be avoided. Risers should be governed by the amount of metal required for feeding when the casting is cooling. A riser is a necessity in steel foundry work, but often is misapplied in malleable and gray iron. When not properly covered and protected, risers invariably produce dirty castings.

Discuss Short Anneal

The malleable round table session brought out some interesting points in relation to recent developments in the short anneal. W. R. Bean, Grindle Fuel Equipment Co., Harvey, Ill., stated that it is possible to produce satisfactory malleable castings with only 2½ hours anneal, but not on a commercial scale. Further, it is possible to produce 10 tons of good castings with a short anneal, where 40 or 50 tons, due to the greater mass of material will not permit the penetration of heat fast enough to give good results on a short cycle. Distortion and oxidation are factors which affect rapid annealing unfavorably.

The steel round table considered sand problems, while that on nonferrous metals concerned itself mainly with the difficulties encountered in casting aluminum. The cost session was devoted mainly to consideration of the standard cost system of the Gray Iron institute.

Chairman Freund of the apprenticeship round table brought out in his discussion the fundamental factors underlying proper training proceedure, stressing particularly the responsibility of foremen and department heads. It is desirable to keep the apprentices interested, to acquire and hold their confidence, to give them proper instruction and to emphasize training over production as the main point which the management expects from the apprentice. The attitude is summarized in the statement that the foremen and those responsible for the training plan should view their relationship as that of a true father.

At three in the afternoon more than 250 gathered for a short technical session, under the chairmanship of Hyman Bornstein. R. F. Harrington spoke on sand control and reclamation. The first steps toward study of sand problems in the foundry, according to Mr. Harrington, date back to the early 1900 efforts of the American Foundrymen's association to develop facts and methods of tests. In 1922 three papers at the annual convention touched on sand problems. This number was increased to eight papers in 1923, ten in 1924 and from four to six every year thereafter. The association has developed and has available for general use a series of tests covering bond strength determined by tension and shear, permeability, dye adsorption and grading. The dye adsorption method measures the quality of clay. It is necessary to have a knowledge of sand, clay bond, sea coal, and facings if the modern foundry is to secure uniform results in molding. Grading methods should govern all purchases of sand. The Hunt-Spiller company, with which Mr. Harrington is connected, buys clay for rebonding, and specifies its minimum dye adsorption in the dye test and its fineness according to the American Foundrymen's association standards. Sea coal must contain 35 per cent volatile matter and have an ash under 10 per cent. The various clays such as Wyoming, Illinois, Ohio and Pennsylvania types all serve distinct and valuable purposes in different types of molding. On heavy gray iron work the Hunt-Spiller company uses only 6 per cent of new material added daily to the sand heaps and of this only ½ per cent of clay is required. With a total scrap loss of 3 per cent, only 1 per cent is attributed to the sand.

The closing address of the afternoon session was delivered by E. W. Page, General Electric X-Ray Corp., Chicago, who showed the manner in which radiographs point out casting faults which may be corrected by proper gating or other changes in manufacturing procedure. Mr. Page's talk was illustrated by lantern slides which showed many interesting examples of dirt, shrinkage, gas holes and inclusions apparent to the X-ray.

The dinner meeting, attended by 375 men was presided over by S. T. Johnston, S. Obermayer Co. and National Engineering Co., Chicago, past president of the American Foundrymen's association. The principal speaker was S. W. Utley, Detroit Steel Casting Co., Detroit, also a past president of the American Foundrymen's association. Mr. Utley stressed the actuating motives of modern industry, affirming that these are not entirely materialistic, but are based upon a real sense of responsibility to society, a higher selfishness which realizes that greater returns are dependent upon greater accomplishments in furnishing better commodities to a greater number of human beings.

The committee of the Quad City group which managed the sessions was headed by the following chairmen: F. W. Kirby, John Deere Spreader Works; John H. Ploehn, French & Hecht; A. E. Hageboeck, Frank Foundries Corp.; John H. Diedrich, Blackhawk Foundry & Machine Co.; Hyman Bornstein, John Deere & Co. These men were assisted by C. E. Hoyt, executive secretary and R. E. Kennedy, technical secretary of the American Foundrymen's association.

Foundries Establish Safety Records

Two Pennsylvania foundries established enviable safety records during the year 1929, according to the department of labor and industry of that state. The Fairmount Foundry Co., Philadelphia, with 92 employes operated 68 days between Aug. 27 and Oct. 29 without a lost time accident. The second foundry the Marion Machine, Foundry & Supply Co., Scottdale, Pa., did not have a lost time accident from Feb. 1 to Sept. 1, with 68 employes. The bulletin states that the Aluminum Co. of America, New Kensington, Pittsburgh, has conducted a survey of all accidents during the first 9 months of 1929 and found that 56 per cent of all accidents were sustained by employes who had been in the service of the company less than 6 months.

Completes Organization

The Chicago chapter of the Gray Iron institute has been fully organized and has elected the following officers: A. W. Lemms, Elizabeth street Foundry, president and C. B. Magrath, North Western Foundry, secretary. A group also has been formed in the Boston-Worcester district to study the institute cost system and the Buffalo chapter has completed its preliminary work and elected J. H. Pohlmann, J. W. Pohlmann Foundry, president and A. U. Ogden, Steel Drum Accessories Co., secretary.

The Greenite Co. Inc., Buffalo, has moved its plant from 1-15 Newfield street to 1392 Niagara street, where it has larger warehouse, manufacturing and shipping facilities.

SAND CONTROL
Increases Economy in the Foundry

Numerous Synthetic Sand Mixtures Give Concordant Data for Rapid Method of Determining Active Bond

By O. E. J. Abrahamson

TO FURTHER co-ordinate, strengthen and correct research work done prior to the studies on the influences of *pure* bond and water on clean, uniform grains as well as to prove still further the theories developed during this work, it was decided to proceed along a somewhat different line.

Consequently, sufficient amounts of thoroughly mixed samples of three natural substances were secured. One was a clean lake sand, another a medium, low-bond molding sand and the third a surface clay high in colloidal bond content. These three samples were analyzed and tested carefully. The lake sand contained 94.83 per cent silica, 2.78 per cent iron and aluminum oxides, 1.02 per cent lime and 0.96 per cent magnesia. The screen test showed the following:

Amount	Per cent
on 20 mesh	0.55
on 35 mesh	5.05
on 65 mesh	73.50
on 100 mesh	17.95
on 150 mesh	2.30
on 200 mesh	0.15
on 240 mesh	0.05
on 270 mesh	0.05
on 300 mesh	0.05
on pan	0.10

Synthetic Sands

TO ESTABLISH a firm foundation for carrying on further research work on molding sands, the author decided to make a series of synthetic sands containing different proportions of clean lake sand, a low-bond molding sand and a surface clay. These sands were tested for permeability, hardness, green and dry bond strength with a full range of moisture contents. Results obtained from these tests are described in this second section of a series of articles on sand testing and interpretation of the results. The third section will follow in an early issue.

Results on the other materials are given in Tables I and II.

The three base materials then were mixed in a total of 26 different combinations. Each combination was tested, using a full range of moisture percentages, for permeability at one and three rams, hardness, green bond strength and dry bond strength. These determinations are tabulated in Tables III and V. In this set of tests the strength was obtained by the shear test method.

Test data obtained from these mixtures facilitated in revising and plotting the influence of moisture on the hardness for mixtures having various percentages of bond as well as the influence of moisture on the ratio between the permeabilities at one and three rams on these same mixtures.

Since these two tests are influenced chiefly by the percentage of moisture and bond and in a small degree by the size and shape of the grains it follows that by combining the curves from these two tests, both having percentage of water in common, the resultant set of curves presents a simple, indirect method for the determination of the percentage of bond in a molding sand or molding sand mixture, with a fair degree of accuracy. The resultant curves are shown in Fig. 14.

Since the influence of moisture on

Table I

Analysis of Medium, Low Bond Sand

Chemical Analysis		Plasticity		Sieve Analysis on grain separated with ammonia	
Element	Per cent			Mesh	Per cent
Original					
SiO_2	85.96			On 20	0.00
Al_2O_3	7.28	A	21.40	On 35	.40
Fe_2O_3	3.08	B	none	On 65	16.50
CaO	1.02	No.	none	On 100	27.20
MgO	0.57			On 150	26.70
Loss on ign.	2.00			On 200	4.67
Bond					
SiO_2	46.06			On 200	10.35
Al_2O_3	29.83	A	70.40	On 240	2.95
Fe_2O_3	11.07	B	38.55	On 270	3.10
CaO	0.98	No.	31.85	On 300	.80
MgO	1.53			No. Pan	10.20
Loss on ign.	10.84				
Grains				Bond	
SiO_2	90.47				
Al_2O_3	5.65	A	21.96	By actual weight	6.55
Fe_2O_3	1.38	B	none	By grain diff.	8.00
CaO	1.18	No.	none	Average	7.25
MgO	0.50				
Loss on ign.	1.08				

Table II

Analysis of Surface Clay

Chemical Analysis		Plasticity		Sieve Analysis on grain separated with ammonia	
Element	Per cent			Mesh	Per cent
Original					
SiO_2	67.37			On 35	0.73
Al_2O_3	16.81	A	41.10	On 65	3.60
Fe_2O_3	7.00	B	25.30	On 100	2.63
CaO	1.20	No.	15.80	On 150	5.13
MgO	1.17			On 200	4.67
Loss on ign.	6.30				
Bond				On 240	2.14
SiO_2	55.75			On 270	4.53
Al_2O_3	23.81	A	61.65	On 300	2.20
Fe_2O_3	8.75	B	31.55	On Pan	74.50
CaO	1.02	No.	30.10		
MgO	1.42				
Loss on ign.	8.72			Bond	
Grains					
SiO_2	74.85			By actual weight	41.80
Al_2O_3	10.90	A	28.95	By grain diff.	46.20
Fe_2O_3	6.12	B	26.20	Average	44.00
CaO	1.40	No.	2.75		
MgO	1.09				
Loss on ign.	4.95				

the two different tests, hardness and permeability ratio, also has been equalized by their combination, it is possible to take a sample of tempered sand, whether new or from the foundry, and determine with a minimum error and time consumed, the percentage of active bond in the sample, regardless of the moisture content. This is accomplished by obtaining the hardness and the permeability ratio of the sand. Using Fig. 14 follow the line indicating the permeability ratio across the chart until it intersects the line indicating the hardness. Then drop vertically to the percentage of active bond. However, to obtain a more accurate test, when analyzing a new sand, it is advisable to average the tests for hardness, permeability and ratio at the optimum water content, that is, the percentage of moisture that gives the highest permeability, and 1 per cent below and 1 per cent above this point.

Testing The Bond

The term *active* bond has been employed in several places in these articles since, particularly in foundries where clay bond is used, particles of bond that are not broken up but are in form of large grains and therefore are not active as a bond for the sand grains, might be intermixed.

Consequently, with three simple pieces of equipment, the permeability device, the hardness tester and a simple electrical moisture testing device, which will be described fully later, it is possible to determine in about 2 minutes the characteristics of a molding sand that are essential for satisfactory results in the foundry, namely, openness or permeability, bond and moisture.

The degree of accuracy by which bond may be determined by the indirect method may be seen in Table V where in the column under the heading bond both the actual bond as determined by careful analysis of the base materials and calculated for each mixture as well as the active bond obtained by tests, are shown. The average for the former for the 25 mixtures involved is 13.8 and the average for the latter 13.1. The speed with which these determinations may be made must also be borne in mind.

However, there are cases where the method will not work to perfection. For instance difficulty will occur in the steel foundry, where sharp sands are mixed with clays, ground silica, organic bonds of a great variety, etc., or in mixtures where highly colloidal clays such as bentonite are used or where extremely fine inert substances are mixed with coarse grains.

To determine the error that might occur in one of these cases, in one set of tests pure silica flour, a clean lake core sand and a surface clay were employed. While for another group of experimental mixtures two clean grained natural sands, one a lake sand and the other a silt obtained from the banks of the Missouri river, were used.

As mentioned previously what has been termed pure bond, judging from its chemical analysis, contains some free silica. However, when particles become extremely fine, that is, with

Table III

Comparative Data on Sand Mixtures

Test No.	Sand Mixture: Lake Sand Per cent	Molding Sand Per cent	Surface Clay Per cent	Per cent Bond Actual (Calculated)	Permeability: Average at 3, 5, 7 and 9 Per cent Water	At Optimum Water Cont.: Permeability	Moisture Per cent	Average Perm. Ratios—Opt. ± 1 Per cent	Avg. Hardness Opt. ± 1 Per cent	Shear Test Strength: Green Bond Avg. at Opt. Water Content ± 1 Per cent lbs.	Dry Bond—Avg. at Opt. Water Content, ± 1 Per cent. lbs.
1	50	50	0	3.6	63.0	68.3	6.0	1.38	22.0	0.49	3.35
2	50	40	10	7.3	33.1	{47.0 47.0	{6.0 7.0}	1.64	18.8	1.05	5.73
3	50	30	20	11.0	24.1	41.7	8.0	2.33	17.2	1.42	9.33
4	50	20	30	14.7	18.6	35.0	7.0	2.56	14.8	2.48	8.60
5	50	10	40	18.3	11.2	{31.2 31.2	{8.0 9.0}	3.08	13.2	2.77	11.87
6	50	0	50	22.0	5.4	19.2	10.0	4.72	11.7	3.92	15.20
7	0	50	50	25.6	1.85	16.7	12.0	5.24	11.2	4.28	18.90
8	10	50	40	21.2	3.90	{15.8 16.0	{11.0 12.0}	4.17	12.4	3.03	11.97
9	20	50	30	16.8	9.8	24.8	9.0	2.85	13.7	2.42	8.07
10	30	50	20	12.4	20.0	33.4	7.0	2.08	14.3	1.72	5.07
11	40	50	10	8.0	34.4	50.7	8.0	1.81	19.2	0.85	5.50
12	40	10	50	22.7	2.37	22.7	11.0	3.95	11.8	3.63	18.67
13	30	20	50	23.5	2.24	17.3	11.0	4.16	11.3	3.93	11.30
14	20	30	50	24.2	1.56	13.4	11.0	4.24	11.6	4.43	13.53
15	10	40	50	24.9	....	....	....	....	....	....	....
16	75	0	25	11.0	34.9	60.5	6.0	2.05	15.1	1.53	6.98
17	70	5	25	11.4	30.2	55.2	6.0	2.15	14.8	1.82	5.73
18	65	10	25	11.7	28.1	46.3	6.0	2.10	15.2	1.78	4.87
19	60	15	25	12.1	24.7	{43.1 45.7	{7.0 8.0}	2.49	15.9	1.78	6.07
20	55	20	25	12.5	21.8	{34.7 39.7	{7.0 8.0}	2.76	15.7	1.90	6.07
21	50	25	25	12.8	18.3	33.5	8.0	2.54	15.6	2.03	10.90
22	75	25	0	1.8	100.5	119.0	5.0	1.22	27.9	0.29	1.78
23	70	25	5	4.0	79.9	93.7	6.0	1.35	24.2	0.32	....
24	65	25	10	6.2	63.5	86.2	5.0	1.52	20.8	0.47	3.70
25	60	25	15	8.4	46.8	62.5	6.0	1.75	18.3	0.88	10.67
26	55	25	20	10.6	32.7	50.7	6.0	1.90	15.3	1.62	5.03
Average				13.8	27.4						

Table IV

Influence of Fine Sand Particles

A study of physical characteristics of extremely fine particles of pure silica and their influence on the new indirect method for the analysis of molding sand and molding sand mixtures.

Substances used — Silica flour that passes a 300 mesh sieve
Chemical analysis — SiO_2 — 99.38 per cent.
In suspension in 1.0 per cent ammonia solution
After 30 min. — 21.5 per cent.
After 30 hrs. — 6.5 per cent.

Mixtures per cent: Silica Flour	Core Sand	Clay	Moisture (optimum)	Permeability (Maximum)	Permeability Ratios—1 and 3 Rams	Hardness	Bond (by new indirect method)	Green Strength (Shear Test)
20	80	..	7.0	89.3	1.56	22.0	5.05	0.40
50	50	..	12.0	11.2	3.72	19.5	11.2	1.40
30	50	20	11.0	8.3*	4.82*	15.7*	15.7	Not determined

*Avg. at optimum & ± 1.0 per cent moisture.

According to the mixture 20-80, the silica flour contained, $\frac{20}{100} \times X = 5.05$ or 25.25 per cent bond and on the basis of the mixture 50-50, $\frac{50}{100} \times X = 11.2$ or 22.4 per cent bond and on the basis of the 30-50-20 mixture,

$\frac{30}{100} \times X + \frac{20}{100} \times 44.0 = 15.7$ or 23.0 per cent bond.

FIG. 5—SAND GRAINS PASSING THROUGH 35 MESH AND RETAINED ON 65 MESH SIEVE. FIG. 6—SAME WITH 5 PER CENT BOND MATERIAL. FIG. 7—SAME AS FIG. 5 WITH 10 PER CENT BOND MATERIAL

Table V

Comparative Data on Sand Mixtures

Test No.	Sand Mixture: Lake Sand per cent	Sand Mixture: Molding Sand per cent	Sand Mixture: Surface Clay per cent	Bond Per cent: Actual (Calculated)	Bond Per cent: By Test	Permeability—Avg. for 3, 5, 7 & 9 per cent moist.: By Test	Permeability—Avg. for 3, 5, 7 & 9 per cent moist.: Calculated	Per cent Pan Material	Avg. Grain size excl. of bond and pan material, as determined by std. sieves. Dia. inch	Avg. Grain size, as determined by charts and tables exclusive of bond and pan material. Dia. inch
1	50	50	0	3.6	4.3	63.0	58.2	4.785	0.0053	0.0056
2	50	40	10	7.3	7.1	33.1	38.7	8.010	0.0054	0.0048
3	50	30	20	11.0	10.5	24.1	24.1	11.230	0.0054	0.0054
4	50	20	30	14.7	13.5	18.6	14.5	14.454	0.00545	0.0064
5	50	10	40	18.3	17.8	11.2	8.3	17.677	0.0055	0.00675
6	50	0	50	22.0	23.1	5.4	4.4	20.900	0.0056	0.0064
7	0	50	50	25.6	24.6	1.85	1.4	25.585	0.00395	0.0048
8	10	50	40	21.2	21.1	3.9	3.3	21.425	0.0042	0.0048
9	20	50	30	16.8	16.3	9.8	8.0	17.255	0.0045	0.0052
10	30	50	20	12.4	12.4	20.0	16.6	13.105	0.00476	0.0054
11	40	50	10	8.0	7.6	34.4	32.0	8.945	0.0050	0.0053
12	40	10	50	22.7	22.1	2.37	3.7	21.862	0.0053	0.0040
13	30	20	50	23.5	23.3	2.24	2.5	22.774	0.0047	0.0043
14	20	30	50	24.2	22.8	1.56	2.1	23.71	0.0044	0.0037
15	10	40	50	24.9	.....	.....	.....	.....	.....	.....
16	75	0	25	11.0	11.2	34.9	35.6	10.495	0.00702	0.00685
17	70	5	25	11.4	11.9	30.2	30.9	10.963	0.00658	0.0065
18	65	10	25	11.7	11.4	28.1	27.1	11.432	0.00622	0.0063
19	60	15	25	12.1	12.2	24.7	23.6	11.900	0.0059	0.0060
20	55	20	25	12.5	13.2	21.8	21.0	12.37	0.00565	0.0058
21	50	25	25	12.8	12.7	18.3	19.2	12.84	0.00543	0.0053
22	75	25	0	1.8	1.5	100.5	94.0	2.45	0.0064	0.0067
23	70	25	5	4.0	3.2	79.9	70.0	4.53	0.0062	0.0068
24	65	25	10	6.2	5.5	63.5	52.4	6.605	0.00598	0.0068
25	60	25	15	8.4	7.9	46.8	37.8	8.69	0.0058	0.0067
26	55	25	20	10.6	10.7	32.7	26.6	10.765	0.00562	0.0064
Ave.				13.8	13.1	27.4	26.2	13.7	0.00544	0.00572

diameters less than 0.0001-inch, due to their tremendous surface, surface tension, capillarity etc., they act in a measure in the same way as colloidal clay. The results from the first set of experiments, using extremely fine silica flour, are shown in Table IV. It will be noted on this table that all the tests made definitely point to the presence of fine material that acts substantially in the same manner as would colloidal clay. It was furthermore gratifying to observe that whether the silica flour was mixed one way or the other with sharp sand or with sharp sand and clay the results with the indirect method were practically the same. Consequently even with such artificial, seldom employed mixtures the method was proved to be fundamentally correct.

The result from the second set of experiments using various mixtures of Missouri river silt and a clean lake core sand are shown in Tables VI and VII. The sieve analysis of this silt was as follows:

Amount	Per cent
on 20 mesh	0.3
on 35 mesh	0.2

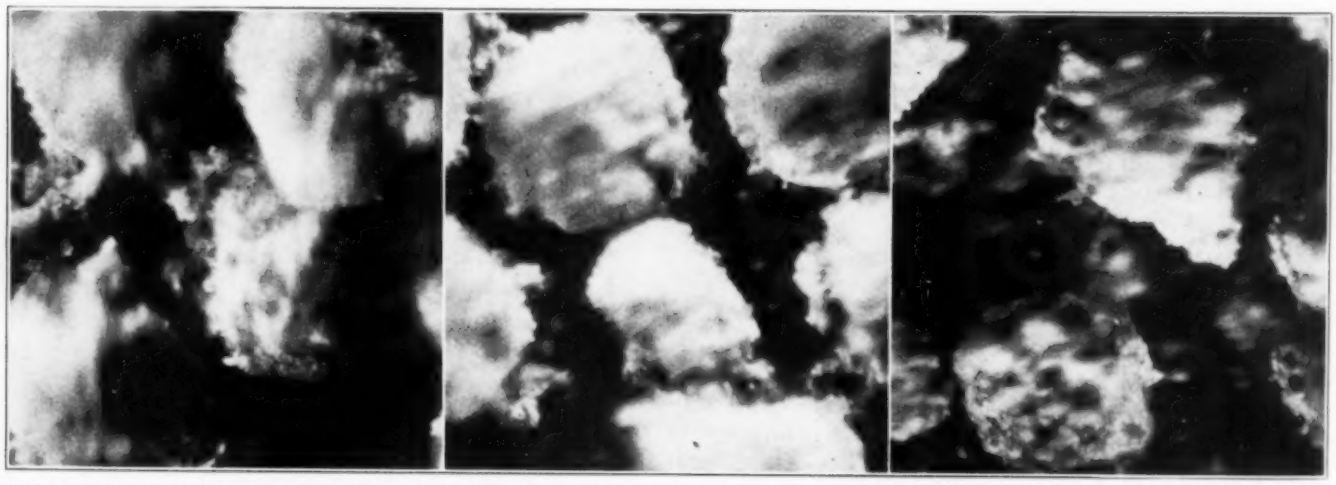


FIG. 8—SAND GRAINS PASSING THROUGH 35 AND RETAINED ON 65 MESH SIEVE WITH 15 PER CENT BOND MATERIAL. FIG. 9—SAME SIZED GRAINS WITH 20 PER CENT BOND MATERIAL. FIG. 10—APPEARANCE OF THE SAME GRAINS WITH 25 PER CENT BOND MATERIAL

Table VI

Hardness and Bond of Mixtures

Mixture Per cent		Permeability				
Lake Core Sand	Missouri river Silt (washed)	Average at 3, 5, 7 and 9 Per cent Moisture	Maximum	Ave. Permeability Ratio for One and Three Rams at Opt. & ± 1 per cent Moist.	Average Hardness at Opt. & ± 1 per cent Moist.	Per cent Bond by New, Indirect Method
100	0	175.0	208.0	1.18	30.0+	None
90	10	108.6	150.0	1.29	30.0+	None
80	20	55.8	75.0	1.48	26.0	2.9
70	30	27.0	39.1	1.70	26.9	3.3
60	40	13.1	16.2	1.83	21.8	6.2
50	50	8.8	9.3	1.56	21.0	5.5
40	60	7.3	8.0	1.67	20.2	6.4
30	70	6.9	7.7	1.54	21.0	5.5
20	80	7.0	7.4	1.52	22.0	4.8
10	90	7.3	7.7	1.55	22.5	4.5
0	100	7.2	7.8	1.38	21.0	5.0

Table VII

Green and Dry Strengths of Mixtures

Mixture Per cent		Permeability		Green Strength (Shear Test)		Dry Strength (Shear Test)		
Lake Core Sand	Missouri River Silt (Washed)	Average at 3, 5, 7 & 9 Per cent Moisture	Maximum	Average at 3, 5, 7 & 9 Per cent Moisture	Maximum	Average at 3, 5, 7 & 9 Per cent Moisture	Maximum at	Per cent Moisture
				lbs.	lbs.	lbs.	lbs.	
100.0	0	175.0	208.0	None	None	None	None	...
90.0	10	108.6	150.0	None	None	None	None	...
80.0	20	55.8	75.0	0.44	0.45	9.7	13.0	9.0
70.0	30	27.0	39.1	0.56	0.70	11.1	15.2	9.0
60.0	40	13.1	16.2	0.74	0.90	12.6	16.8	7.0
50.0	50	8.8	9.3	0.88	0.95	16.2	21.0	9.0
40.0	60	7.3	8.0	0.91	1.00	13.2	17.6	9.0
30.0	70	6.9	7.7	0.89	0.95	12.8	17.6	9.0
20.0	80	7.0	7.4	0.86	1.00	10.5	15.4	9.0
10.0	90	7.3	7.7	0.91	1.05	8.7	10.8	9.0
0.0	100	7.2	7.8	0.88	1.10	4.9	7.4	5.0

on 65 mesh	0.3
on 100 mesh	0.3
on 150 mesh	1.0
on 200 mesh	4.8
on 270 mesh	23.4
through 270 mesh	69.7

Microscopic examination of this silt after it had been carefully washed free of organic and other foreign matter with distilled water showed, as also is indicated by the sieve analysis, an extremely fine, oblong, sharp pointed and flaky grain structure. That some of the grains were sufficiently fine to act as colloidal clay and that possibly a small percentage of bond of some unusual nature was present, is indicated by the tests for bond by the indirect method as well as by the tests for green and dry bond strength.

The most commonly employed mechanical tests for the bond of molding sands in control work in the foundry are the green and dry strength tests. Strength, however, is dependent on the percentage of moisture in the sand both when considering green bond and dry bond strength. Results obtained by the indirect method for bond in comparison with green strength are shown in Table VIII. It will be noted that the percentage method is practically uniform at the various percentages of moisture, while the green strength varies in all cases substantially and in some particular cases as much as 30 per cent within a range of moisture that may at any time be encountered in the foundry.

This emphasizes again the difficulties that might be experienced, especially in the continuous foundry, if additions of bond and new sand are

Table VIII

Variation Between Bond and Shear

Exp. No.	2		25		16		17		19		20		21		26	
Moisture %	Bond %	Shear Str. lbs.	Bond %	Shear Str. lbs.	Bond %	Shear Str. lbs.	Bond %	Shear Str. lbs.	Bond %	Shear Str. lbs.	Bond %	Shear Str. lbs.	Bond %	Shear Str. lbs.	Bond %	Shear Str. lbs.
5	7.15	1.32	8.20	1.05	12.0	1.80	12.1	2.15	12.6	1.70	11.8	2.20	12.0	1.95	10.4	1.75
6	7.00	.92	7.70	.85	11.2	1.50	12.1	1.80	11.4	2.00	....	....	....	....	11.0	1.70
7	7.00	.83	7.70	.75	11.0	1.30	11.1	1.50	12.1	2.00	12.5	2.25	12.1	2.20	10.6	1.51
8	....	....	....	....	....	....	....	....	12.3	2.05	13.2	1.75	12.4	2.10	10.1	1.20
9	....	....	....	....	9.8	.90	11.2	1.20	11.9	1.30	13.5	1.70	13.3	1.80	9.4	.95
10	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
11	6.80	.61	7.60	.55	....	....	....	....	....	1.20	12.0	1.30	11.5	1.90	11.7	1.00
12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
13	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Opt. Moist. %	6.0		6.0		6.0		6.0		8.0		8.0		8.0		8.0	

Per cent bond obtained with new method of analysis at different percentages of water as compared with shear tests on identical sand specimen (green).

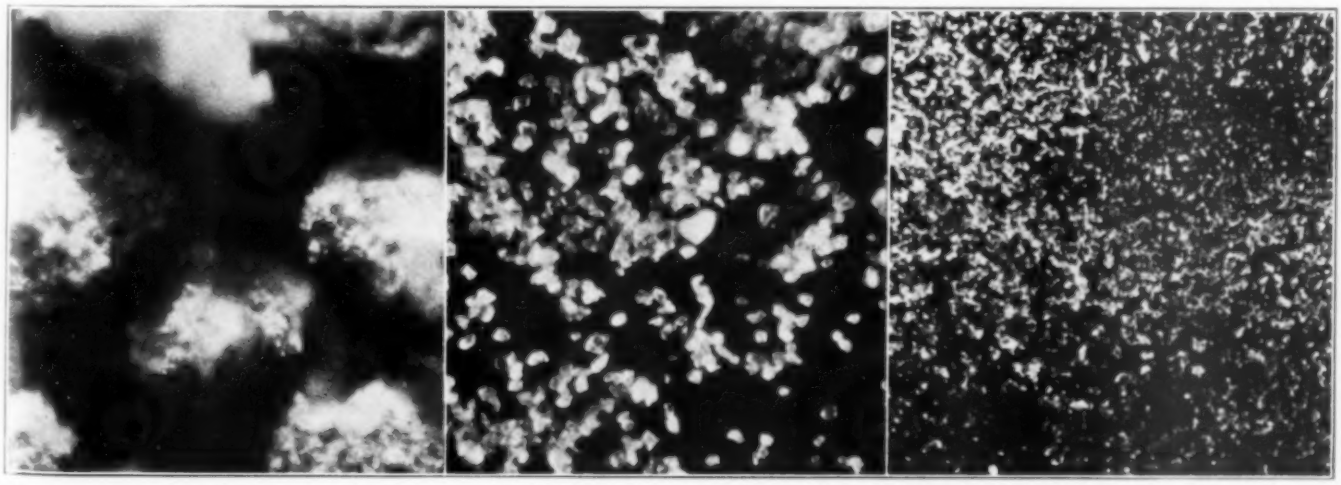


FIG. 11—SAND GRAINS PASSING THROUGH 35 AND RETAINED ON 65 MESH SIEVE WITH 30 PER CENT BOND MATERIAL. FIG. 12—SUB-PAN MATERIAL ABOUT 0.0005-INCH DIAMETER. FIG. 13—THE BOND MATERIAL IS FINELY DIVIDED

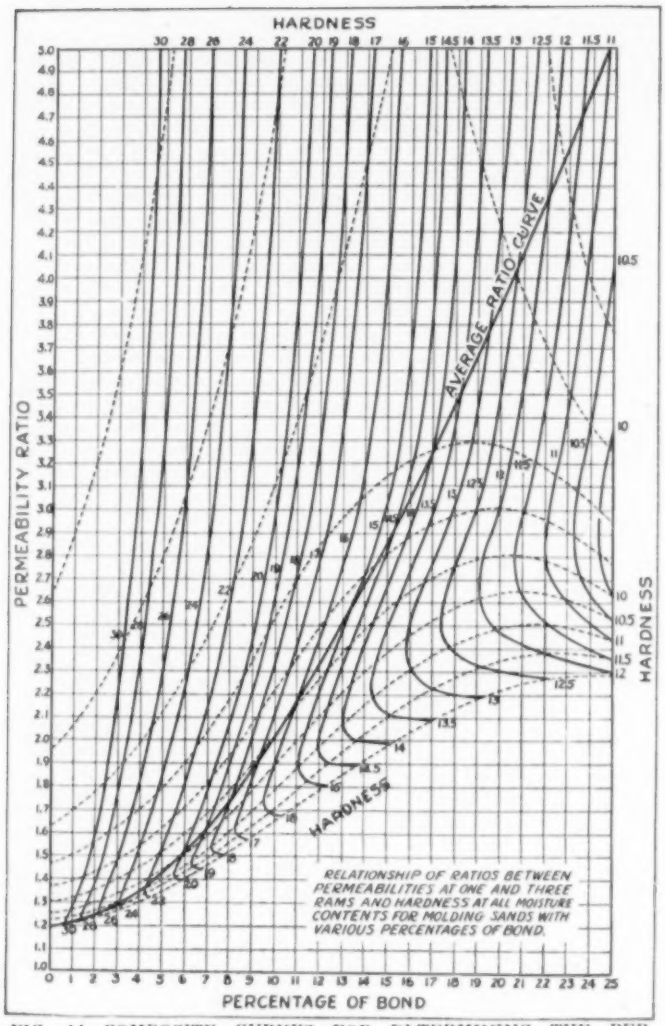

HARDNESS
PERMEABILITY RATIO
AVERAGE RATIO CURVE
HARDNESS
RELATIONSHIP OF RATIOS BETWEEN PERMEABILITIES AT ONE AND THREE RAMS AND HARDNESS AT ALL MOISTURE CONTENTS FOR MOLDING SANDS WITH VARIOUS PERCENTAGES OF BOND.
PERCENTAGE OF BOND

FIG. 14—COMPOSITE CURVES FOR DETERMINING THE PERCENTAGE OF BOND MATERIAL FROM THE HARDNESS AND PERMEABILITY RATIO TESTS

based on the results obtained with strength testing apparatus.

It has further been claimed by some investigators that the shear test is particularly valuable as a test for bond when made on a dry specimen. That this is not always true may readily be observed from Table VII, where the dry bond strength for a mixture of various sized grains, free from bond as far as can be done by washing, ran as high as 21 pounds, indicating approximately 25 per cent actual bond. This high strength for a mixture of grains having no bond is due evidently to interlocking grains and the resultant friction that is set up between these grains. A specimen prepared from such a mixture and dried has a soft easily abraded edge, while a dried specimen giving the same strength but prepared from a mixture of rounded grains and true bond has an edge that is hard and sharp and that can not be rubbed off with the finger. This feature is almost a necessity as the mold must be such that it will stand the cutting action of the molten metal. Easily abraded material will have a tendency to wash away and be carried to other parts of the mold.

Therefore, it is apparent that although a sand may show a high dry bond strength, considerable trouble may arise in the foundry from its use in the form of dirt, washes, scabs, drops, etc., since the true bond may be low. Hence, many of these faults which in the past have been blamed on the molder, may be caused by the material he has to use rather than to that unknown referred to as the human element.

Another difficulty encountered in judging a sand by its dry bond strength is the considerable variation between the results obtained at different moisture percentages even within as narrow a limit as 1 per cent, as shown by the following results obtained from shear tests on dry bond strength. The values enumerated under the various moisture contents are given in pounds:

Moisture Content		
—1 Per cent	Optimum	+1 Per cent
3.70	4.70	7.80
8.50	11.30	12.20
4.15	5.40	11.40
4.20	4.40	8.60
2.60	4.80	7.20
4.00	4.20	10.00
4.20	6.00	8.00
10.00	10.60	15.40
3.80	3.50	7.80

This is the second of a series of articles on the subject of sand control. The third will appear in an early issue.

The Editors.

Steel Group Studies Selling Problems

STEEL foundry operations are reported satisfactory, with the prospect for continued steady demand running through the next two months, according to the concensus of opinion expressed at the St. Louis regional meeting of the Steel Foundry Society of America, held March 27. Due to the illness of E. H. Cornelius, Oklahoma Steel Castings Co., Tulsa, Okla., who was scheduled to preside, Burtner Fleeger of the same company acted as chairman of the morning session. More than fifty foundrymen from the surrounding district, many from Michigan, Ohio and southern Wisconsin and some from the southwest were in attendance. Chairman Fleeger drew the comparison with earlier historic river crossings in remarking that this was the first time the society had crossed the Mississippi to hold a meeting. Reports of the cost committee, commercial and technical research committees were presented.

The society and its work formed the subject of an address by Granville P. Rogers, managing director, New York, who cited the accomplishments since the organization meeting in Chicago last fall. A definite impulse has been given the entire industry, according to Mr. Rogers and the effect of organization activities will be amplified as more members join the movement.

President John E. McCauley, Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa. presided at the luncheon session, where John B. Edwards welcomed the society in the name of the St. Louis chamber of commerce. Clark McKercher, New York, counselor of the S.F.S.A. contrasted present day trade association practice with those which obtained some years ago.

The early part of the afternoon session was devoted to voluntary discussion of new uses of steel castings, under leadership of L. S. Peregoy, Sivyer Steel Casting Co. Milwaukee. This roundtable was followed by an address by H. S. Greene, merchandising executive, Chain Belt Co., Milwaukee on the subject of merchandising. Mr. Greene cited sixteen don'ts of steel castings merchandising ranging from the evils of worshipping tonnage at low price to that characterized in retail sales practice as "load 'em and

leave 'em," where the salesman never follows to assure that goods are satisfactory and will perform the service intended.

One of the fundamental requirements of good merchandising is to operate so that customers will look through the price to an appreciation of service rendered. Only two places exist through which a steel foundry can make money. One is through economy in production and the other is in selling prices. Economy in manufacturing methods should not be sacrificed to the poor judgment of a salesman who has it in his power to dictate the margin of profit upon a casting. Mr. Greene recommended a philosophical attitude toward turning down orders, the employment of salesmen who thrill at an order obtained at a profit and are ashamed of any order taken at a loss, faith in competitors and their desire to make a profit and throwing out unprofitable lines.

The next meeting of the Society will be held at Hotel Hollenden, Cleveland, on May 13 and 14, in conjunction with the convention of the American Foundrymen's association.

Points Out Society's Value

Granville P. Rogers

NEVER since the formation of the United States Steel Corp. in 1901 has such a gigantic upheaval swept the steel industry as is now shaking the structure of that most basic of industries and reaching into almost all branches of the business. Huge corporations are taking form over night. New methods and processes are revolutionizing operations which have been considered standard ever since the commercial production of steel.

A whole new family of alloys, which have followed the stainless steel patent of Harry Brearley in England in 1916 have made their appearance during the past few years. Every year, almost every month, sees the advent of some new and important combination of metals—and the end is not in sight yet.

Start Constructive Era

What will be next? So far the steel foundry has not been challenged strongly or to the same degree by these surges of invention and discovery. Nevertheless, every business today is confronted with tremendous changes which are taking place in processes and in the development of competition outside the industry. Steel founders also face this situation.

Can the steel foundry industry hope to escape situations that will change the complexion of its business? It is feeling these industrial changes to some extent, and more will come. During the past two years the steel industry with its absorptions, mergers, and combinations of powerful units has started a constructive era which should have far-reaching effects upon the wider use of steel.

Keen men, builders of mergers, have visualized that patents and processes intelligently handled are the key to leadership. They have gathered together in one corporation those concerns whose control of special processes mean a lower fixed capital investment in plants and a lower cost of operation in processes—an unbeatable combination while this advantage holds.

Added to this they are rounding up the available alloys, which are changing overnight, so fast that steel isn't steel any longer. Industry is finding that, in many cases, its requirements are best served by specific combinations of metals which will endure under a wide variety of usages. This field, which is growing larger day by day, cannot now be visualized in its ultimate usefulness.

Conditions Change

THE steel industry is undergoing rapid transformation due to the increasing tendency toward mergers which are compelled, to a more or less extent, by a need for diversification of product, and by inventions of new alloy steels and processes. So far the steel foundry industry has not been challenged to any large extent, but it must be ever watchful to guard its present markets and develop new markets for steel castings. Organized effort is needed as is pointed out in the article which is abstracted from an address presented by Granville P. Rogers, managing director, Steel Founders' Society of America Inc., New York, at a meeting of the society held recently at the Hotel Statler, St. Louis.

Industry in the United States is limited by the federal laws regarding combinations or trusts. We have not the freedom granted in Germany where the cartel can be a 100 per cent monopoly and reap a consequent reward. When the United States Steel Corp. was formed in 1901, it controlled 75 per cent of the country's production and the whole world cried out in protest.

History, however, has proved that the world was wrong. Size has ceased to frighten the consumer who welcomes lower costs made possible by consolidated efforts and control of raw materials.

The steel casting industry can profit by these examples of unified effort. It would serve no useful purpose to merge a hundred scattered foundries serving local areas into one corporation with remote control. No economies could be effected except in possible purchase of materials and the establishment of better foundry practice. The disadvantages of remote control might offset the gain derived from the mentioned improvements.

Adopts New Program

However, the industry has a trade organization—the Steel Founders' Society of America, Inc., a national organization which serves directly the steel foundry interests, and which can be made a clearing house for all that is progressive in your field. It can, to a large extent, take the place of an actual merger of interests and, properly supported, furnish its members with constructive developments in foundry practice, technical research, new uses for castings, and protection from the encroachment of forgings, weldings, stampings and their adverse selling propaganda. It can foster better trade practice, a closer co-operation between executives with its valuable exchange of ideas, and assist in getting more business for its members, under better conditions, and at a profit. Steel foundrymen cannot hope to meet the situation as individuals. Their only hope is in organizing.

The past record of the society is not to be disregarded, but, as is known, the society has recently undergone a reorganization. A survey of the steel foundry industry has been

(Concluded on Page 83)

Fundamentals of
FOUNDRY PRACTICE

Soldiers or Gaggers Projecting Above the Top of the Flask Constitute a Menace—Shaving the Core Print Is Dangerous

By Ivan Lamoureux

[Interpreted in the Light of American Practice by Pat Dwyer]

Part VIII

TO PLACE the soldiers properly, different circumstances as illustrated in Fig. 78 should be considered. Where the soldiers project more than half their length below the crossbars of the flask, they should be nailed to these crossbars. While ramming the first course of sand, the soldiers should be held in place with one hand to keep them from shifting about. In molds designed to be skin dried a layer of sand ⅜ to ¾-inch in thickness should be allowed below the soldiers. Care should be taken to prevent their heads from projecting above the flask.

Make Gaggers Stick

Gaggers are dipped in a bath of clay water to make the sand stick immediately below them. The clay water bath may be quite heavy or thick when working with dry sand and the sand will stick better. In green sand practice the bath is quite light or thin.

In some shops in the United States the gagger is dipped in water and then immediately dipped into flour, then it is shaken so that only a thin layer of flour remains sticking to it, this is a good coating and is wholesome for the sand. However, on account of the expense it has not met with favor throughout the foundry industry.

Ram the Cope

MANY features not found in connection with making the drag of the mold, confront the molder in the preparation of the cope or upper part. The body of sand must be held in suspension above the open cavity of the mold. Over comparatively small areas the cohesion of the sand grains is sufficient to accomplish this purpose, but over larger areas the molder must introduce reinforcing agents to support the sand. These may be formed from wood or metal and whenever possible the upper ends should not project above the top of the flask. Projecting gaggers or soldiers present a hazard and their use should be discouraged. In mending broken areas the sand should be rubbed over the moistened surface with the fingers. Nails are driven through the added sand and into the solid sand of the mold to assist in holding the patch in place.

Finishing a mold is an operation designed to restore the mold to its correct shape after it has been altered through poor molding, defective withdrawal of the pattern, or by a poor roll-over. During or after the drawing of the pattern, some of the sand breaks away and the broken part must be repaired.

The sand may be too dry and no longer has sufficient cohesion. Also it may happen that the sand carried the proper degree of moisture at the time of using it, but ceded its moisture to the pattern and thus became too dry. To avoid this inconvenience, French molders dip the patterns in water and then cover them with a layer of powder or dust before ramming the sand around them.

Watch Ramming

Where the sand is rammed too hard, it sticks in some of the slightly drafted hollows and comes loose in patches which adhere to the bottoms of these hollows when drawing out the pattern. Where the sand is not rammed hard enough it does not have sufficient cohesion to stick when drawing the pattern. Lack of gaggers, soldiers or nails and weak or comparatively weak sand cause more or less sand to remain at the bottom of the hollow.

Where the layer of sand, located below the gaggers is too thick it will remain resting on the pattern. Where the jarring is insufficient, the masses

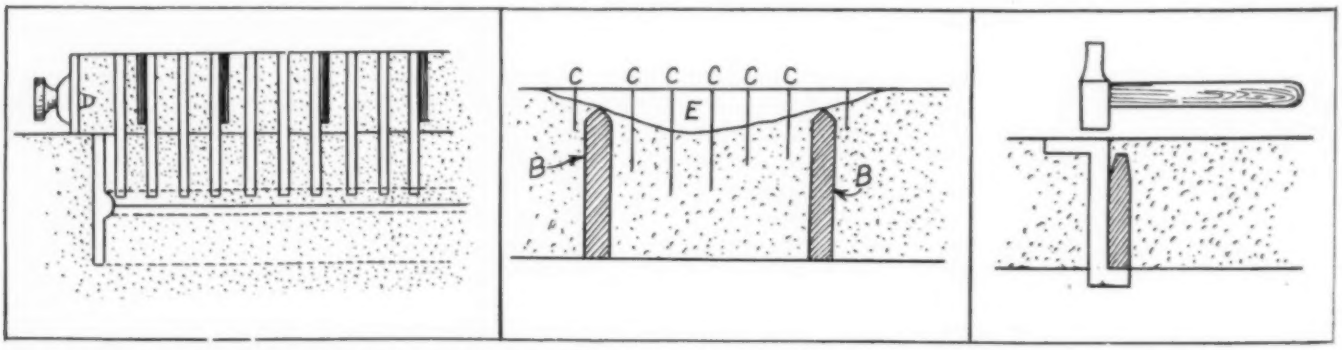


FIG. 78—(LEFT)—WOOD SOLDIERS EXTEND FROM THE BARS DOWNINTO A CAVITY IN THE PATTERN. FIG. 79—(CENTER)—NAILS ARE DRIVEN INTO THE SAND TO HOLD A PATCH. FIG. 80—(RIGHT)—PROPER POSITION OF HAMMER WHEN KNOCKING A GAGGER BACK FROM THE FACE OF THE MOLD

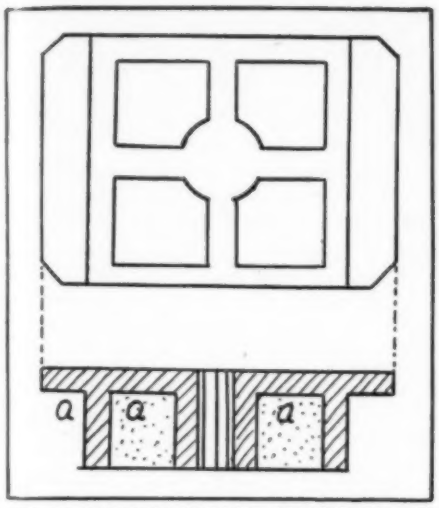


FIG. 81—FILLETS SHOULD BE FORMED BY THE PATTERN OR CUT WITH A TOOL

of sand to be lifted with the cope meet with resistance due to friction against the side walls, and remain at the bottom of the pattern. Sometimes a back drafted pattern arrives in the foundry and of course the sand cannot be lifted clean from a pattern of that kind.

In all cases where sand breaks off on withdrawal of the pattern, the molder should follow exactly the same procedure as that indicated in Part VII of the series which appeared in the April 1 issue. He should push nails *C*, Fig. 79, of sufficient length to be solidly imbedded, into the part *E*, to be replaced. He should work the sand into place with the tips of his fingers. He should do some venting with a thin needle, endeavoring as much as possible to restore the existing vents. The patch is to be smoothed with a small board, and slicked with the trowel.

When the sand is too dry, the broken area should be sprinkled with a little water, then repaired as described. Usually it is preferable to wet the patch after the repairs are completed, to assist in holding the patch in place. When the sand is too wet, care should be exercised in wetting the patch. An excess of moisture generates a large quantity of steam which might cause scabs on the face of the casting.

If water is applied before repairing a green sand mold, when the melted iron enters the mold, it surely will cause the formation of an enormous quantity of steam at that spot. This steam will bulge the end and cause scabs. The molten iron will be thrown out in streams from the mold and the casting will be damaged irreparably.

Wetting the surface after repairing is not at all dangerous. The steam produced by the pouring will escape from the mold by passing through the pores of the sand, and will not cause the sand to bulge. Hence, if only the surface is wetted, the mold retains all its porosity. A green sand mold never should be wetted before it is repaired, as a layer of mortar is created which is impervious to the gases. As a general rule, a moist, mellow and quite

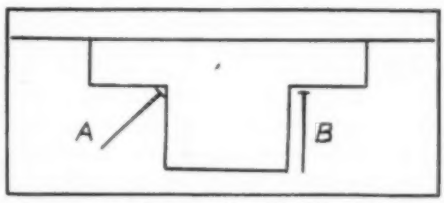


FIG. 82—NAILS IN THE CORNERS SHOULD BE INSERTED AS AT *A* AND NOT AS AT *B*

porous mold is preferable to one that is hard, dry and too compact.

As a result of poor ramming, soft parts often will be found, particularly under the crossbars of the flask, where the sand has not been rammed to the proper density. These soft places should be repaired as follows: Brush the parting sand from the cope. Press

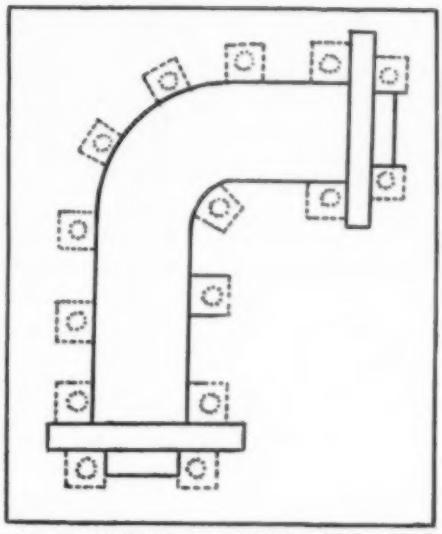


FIG. 83—METHOD OF TESTING THE JOINT WITH SMALL PIECES OF PAPER AND DROPS OF BLACKING

the defective areas with the tips of the fingers. Scratch the impression slightly with the trowel. Fill the cavities with facing sand and press it down with the fingers. Level the patch with a small board, and finish off with the trowel.

To give the mold uniform consistency, the sand always should be spread with the fingers and not stuffed into hollows as a plasterer or painter would do it. Care always should be exercised to conserve all the porosity of the sand. A plasterer's job must be neat and pleasing, and for him the outside appearance of the objects which he fashions must captivate the attention, but for a molder, while the mold he makes should be as neat as possible, above all it must be sound, porous, well vented and strong. A mold polished smooth as a mirror inevitably will produce scabs on the casting.

Sometimes, for example, where a

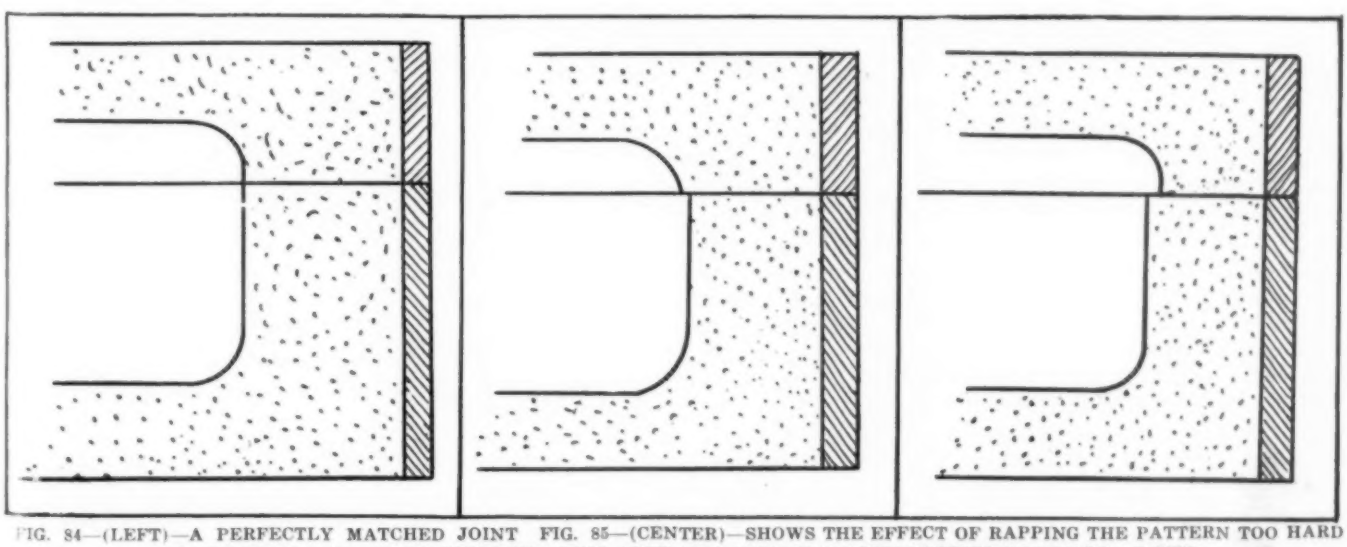


FIG. 84—(LEFT)—A PERFECTLY MATCHED JOINT FIG. 85—(CENTER)—SHOWS THE EFFECT OF RAPPING THE PATTERN TOO HARD IN THE DRAG FIG. 86—IN FINISHING THIS COPE THE SAND HAS BEEN PRESSED TOO HARD AT THE EDGE OF THE MOLD IMPRESSION

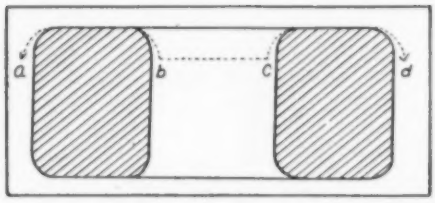


FIG. 87—THE COPE JOINT IS SPREAD A LITTLE ON THE OUTSIDE *a* AND *d* AND REDUCED A LITTLE ON THE INSIDE *b* AND *c*

boss has been introduced between two bars to simplify the joint, the cross-bars come too close to the pattern. Where a thickness of only a fraction of an inch exists between the bars and where the sand has dropped off when drawing the pattern, the defective area should be repaired as follows: Wet the bar carefully. Press the sand in with the tips of the fingers. Apply a light coat of oil which will preserve a certain amount of moisture and prevent the sand from bulging. Furthermore, at the time of pouring, this oil and water vapor will form an inflammable gas that will prevent some accidents.

Adjust the Gaggers

If the bars of the flask are smeared with oil, the excess gas developed when the iron enters the mold will cause the sand to drop off.

Due to misdirected blows of the rammer, some of the gaggers may project below the joint face of the cope. They should be pushed back into the sand a distance of at least ⅜ to ⅝-inch to prevent scabs which might result if the gaggers were covered with only a thin layer of sand.

The toe of the gagger should be tapped lightly with a hammer in the direction of the shank, to drive it in without jarring as shown in Fig. 80. If the gagger is hit on the head, it would be shaken and become loose in the sand. If the gagger is close to a vertical wall of the mold, it should be held firmly while tapping it to prevent cracking the mold.

The hollow produced by pushing in the gagger is filled and leveled off even with the surface. If it is found that the gagger is loose it should be tamped in firmly, both from the top side and the bottom, by ramming sand all around it with an iron bar. Withdrawal of the pattern often causes deformation of the join and breaking away of the edges. In a preceding section devoted to preparation of the joint the method to be followed in reinforcing and repairing the joint was explained.

When broken edges are to be repaired, it is advisable to push in some nails to stiffen the sand. These pins must not be pushed in vertically as shown at *B* in Fig. 82. They might cause the sand at the face to drop off. Insert them as at *A*. It is advisable to put in some vents with a thin needle. If the cavity in the sand is somewhat dry, it should be sprinkled with water. If it is moist enough, proceed with the repair, then wet the new face lightly with a swab. Even though the edges are in good shape, without any breaks in them, a little wetting with the swab will solidify them still more without any danger of causing scabs.

In the mold represented in Fig. 81, the edges *a a* simply should be wetted after drawing the pattern. Of course if the sand is pressed to form fillets, the appearance of the mold will be neater. Unfortunately, castings with scabs are almost sure to result. If, for any reason a fillet must be made, then the sand along the edge is removed with the trowel or other suitable tool so as not to form a hard edge and one that will be impervious to the gases.

The bellows or a jet from the compressed air line should be employed to blow loose sand and other foreign particles out of the mold, instead of scooping them out with a trowel, a lifter or any other tool. Scraping the bottom may spoil it and cause scabs. It is unsafe to crush the particles into the face of the mold, as that hardens the surface and prevents the gas from escaping.

Patterns Draw Easily

Small patterns well designed and well taken care of, draw out of the molds without breaking the sand. Instead of slicking the face with special tools it is only necessary to powder the whole inside of the mold with graphite, replace the pattern in its impression, and rap it smartly a few times and remove it immediately. This process is known as *stamping* or *printing back*.

In this way a perfectly smooth and sound mold is obtained. If the graphite tends to stick to the pattern, it should be covered with a thin layer of powdered charcoal, which absorbs moisture more slowly than the graphite.

Where the patterns and core-boxes have been well designed and provided with the proper draft and necessary clearance, it will not be necessary to shave or retouch the core prints. However, on large diameter cores, for example, over 6 inches, where the axis of the core is in a horizontal plane, the sharp edge of the print may be touched lightly with the slick to prevent the sand from crushing, a contingency that may arise while setting the core in place in the mold.

Where a doubt exists that the core will fit, the sand is shaved with the trowel on the sides of the half-core print in the drag, and over the entire core print in the cope.

When the cope is rolled back preparatory to closing the mold, sand may fall for any of the following reasons: Sand is too dry, a blow is given to the cope when turning it over, one of the dowel pins is struck, the flask is twisted when propping it up to turn it over, or any of the causes listed previously. In each of these cases the mold should be repaired by following the same procedure as outlined for repairing the mold after drawing the pattern.

When a gagger which has been hammered in because it came too near the pattern, shows any plan in its seat, it much be rammed in firmly from the outside of the mold. For that purpose one hand is placed against the face of the mold and with the other hand, sand is rammed in either with the fingers or with a piece of iron.

Sand on Top of Joint

Where the joint has been made up too full, the sand will be crushed by the cope unless the joint is strengthened, or, unless a thin strip of sand is shaved from the upper part to leave a slight clearance along the edge of the mold cavity and over a width of 1-inch.

If the molder believes that the cope does not match exactly with the drag, he can decide the point as follows: Cut some small pieces of paper and place them on the joint of the drag as shown in Fig. 83. Place a drop of blacking on the center of each. Place the strips of paper on the drag along the edge of the joint in such a way that the straight side of the paper comes flush with the edge of the mold

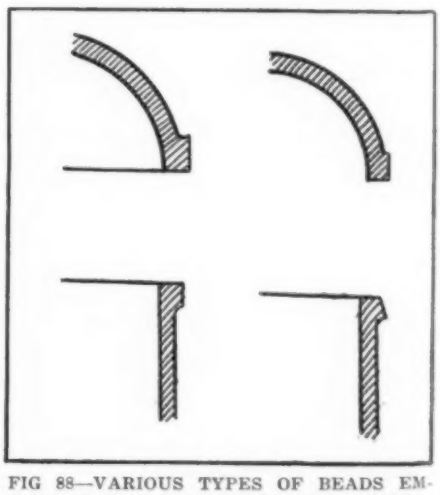


FIG 88—VARIOUS TYPES OF BEADS EMPLOYED TO CAMOUFLAGE THE PARTING LINE

joint. Place the cope in position on the drag. Then remove it and roll it over. All the pieces of paper will stick to the cope. The accuracy of the matching can be readily determined.

The patching of a dry mold differs but little from the patching of a green sand mold. Nails are placed in both in the same manner and the tools are used sparingly to insure maximum porosity in the sand.

Dry sand molding generally is reserved for large castings in which the patterns seldom are as well taken care of as those for small castings. The fillets, which are of little importance in small castings, may exert a great influence on the strength of a large casting.

Use Clay Wash

Since all dry sand molds eventually are dried, the wetting of the broken parts can be done more easily than in green sand molds, to make the patching sand stick, the face of the cavity or broken area can be wetted with clay wash.

When the joint of a mold coincides with a fillet, as in Fig. 84, lifting the cope rarely causes any sand to drop off, if the sand has been well rammed and reinforced with a sufficient number of gaggers.

Even though the cope lifts clean, a mismatch may show on the joint line of the casting. If the pattern is rapped strongly the drag of the mold will be enlarged and will not match exactly with the cope. If a mold is poured in this condition a casting with a considerable variation in size at the joint will result. The part in the drag will be larger than the part cast in the cope, as shown in Fig. 85. It is practically impossible to correct such a defect on account of the large amount of metal extending beyond the joint.

When finishing the cope it is advisable to press the tool on the edge of the mold to make it correspond with the drag. The cope will extend over as in Fig. 86, or at least come up flush, as in Fig. 84, to the joint. After the casting is poured, the part poured in the cope extends slightly over the part poured in the drag. A little trimming with the emery-wheel will even up the two parts.

The same precaution always should be observed when molding two separate and distinct castings which must match perfectly, as for example, a pot and its lid. The molder must rap the cover more than the lower part, and thus reduce to a minimum the work required afterward to secure a perfect fit.

To still further obviate this inconvenience, some painstaking builders either trim the edge with a bead which may be touched easily, as shown at the right in Fig. 88, or with a half-round bead which stays in the rough, as at the left in Fig. 88. A slight shift in the latter case hardly will be noticeable.

In the ring with the rounded edges shown in Fig. 87, where the joint is made along the line *a b c d*, the parts *a* and *d* should be lengthened, and the part *b c* should be cramped as indicated by the dotted lines.

In dry sand molding it is absolutely indispensable that the cores can be entered and taken out of the prints without disturbing the sand in the prints. That is why the diameters of the prints in the horizontal plane, as well as those in the bottom of the drag for flywheels or other castings, are slightly larger in diameter than the cores which are to be placed in them.

To place a core 4 inches in diameter, usually a print 0.11-inch larger in diameter is made, and for a core from 8 to 12 inches in diameter, a print 0.22-inch larger in diameter is made. The same steps are followed in making prints for cores of other than round shapes.

If the height is not too great, for example, in prints at the bottom of the walls, care should be exercised to place the cores before finishing and drying the mold and thus avoid patching and fins.

Points Out Value

(*Concluded from Page* 79)

made and a program, designed to accomplish worthwhile things, has been adopted.

While the new plan of organization is just under way, a considerable number of things are being done that justify investment in membership. The operating data reports and reports in percentage of sales compiled monthly by the society on figures furnished by its members can be, and are, of great value and benefit to the individual foundry. There have been many instances where the proper utilization of these reports has resulted in the saving of thousands of dollars to the individual foundry. These alone make membership worth while.

Material purchased reports are being furnished under the new system and are of value for informative purposes. The cost work that is now being done by the society will, when completed, be of great value to the entire industry. A set of trade customs have been prepared which will result, after general acceptance, in benefit to all foundries as well as to the purchasers of steel castings. Leading men in the industry have had this work in hand and have devoted much of their time to the study and preparation of this work.

A great many things have been done in the way of defending the present market for steel castings. Several companies in promoting the sale of their products have disparaged the steel casting industry, in many instances in an unjustified manner and not based on facts and true information. The society is doing something about this and making some headway.

Extend Steel Knowledge

In addition to defending present markets, the society hopes later on to bring about a greater knowledge on the part of engineers and designers of what modern steel casting practice is and to secure new uses for the product and a consequent enlargement of its market.

The society is carrying on several direct activities such as its material exchange, which is of benefit to individual members. The employment and placement bureau is doing excellent work and the society has been able to place several important men in the industry and furnished members with good men, when they were needed.

The directory, which we are now compiling of the steel foundry industry, will be the most complete ever published. The statistics on production and capacity that now are being collected will be the most authentic ever compiled for this industry when finished.

These things have been put into operation within the last three months. In addition to the matters which have been outlined briefly, considerable personal work has been done in the correction of evils and the eliminating of misunderstandings, all of which are difficult to describe.

Last, but not least, it must be evident to everyone that one of the most valuable things a man gets out of membership in a society is contact with the other fellow. Any member of this society, going to one of its meetings with a definite problem to be solved, or seeking specific information, generally can carry home with him the best answer to his problem.

Brass Foundry Practice

(*Concluded from Page* 71)

brass should be used. As this amount is far from easy to weigh on foundry scales, it should first be weighed and measured. Then a small cup is constructed, which when filled level will just hold the required amount of

the pulverized phosphor-copper alloy.

Albert Portevin, *Journal* of the Institute of Metals (London) Vol. 29, observed from tests made on chill and sand cast specimens of both alpha and alpha-beta brasses that the effect of phosphorus is not appreciable when below 0.5 per cent. In the case of the alpha-beta brasses, both resilience and elongation fall off considerably, and the alloys become hard and brittle with 0.5 per cent phosphorus. With increasing additions above 0.05 per cent for the alpha brasses, a new constituent is found by microexamination. This probably consists of three atoms of copper and one of phosphorus (Cu_3P) which is seen as filaments around the grains. The conclusion is that small amounts of phosphorus are harmless in brasses.

Portevin also claims that while phosphorus can deoxidize copper-tin alloys, this is not the case for brasses. With the latter zinc is the reducing agent, so that in the presence of phosphorus, zinc oxide will remain in the alloy in the form of inclusions. If the phosphorus favors retention of zinc oxide in the alloy, then phosphorus even in small amounts should be kept out of yellow brasses, as it would cause leakers, and not prevent them. However this theory is not in accordance with the facts.

Phosphorus will prevent leakers in yellow brass castings when added in small amounts. Instead of retaining the zinc oxide when as little as 2 ounces of phosphor-copper containing 15 per cent of phosphorus is added, it produces a copious evolution of the zinc oxide in flakes, like snow. This occurs when the zinc content is as low as 12 per cent. In fact this evolution is so disagreeable that the workmen seriously object to working in foundries where too much phosphorus is used in alloys. This includes red brasses that contain a high amount of zinc. Use of too much phosphorus always can be identified by the zinc oxide instead of coming off as a smoke or fog, comes off in flakes like snow.

Institute Holds Meeting in London

THE twenty-second annual general meeting of the British Institute of Metals, was held at the Institution of Mechanical Engineers, London, on Wednesday, March 12. In presenting his report, the secretary of the institute stated that the number of members on Dec. 31, 1929, had reached a total of 2122. Of this, the number resident outside the British Isles was 840, or approximately 40 per cent.

In commemoration of the coming-of-age of the institute, the council elected as fellows President, Dr. W. Rosenhain, and the six surviving past-presidents: Prof. Harold Carpenter, Sir John Dewrance, Engineer Vice-Admiral Sir George Goodwin, Engineer Vice-Admiral Sir Henry J. Oram, Leonard Sumner, and Prof. T. Turner.

The following members who were nominated were declared to be duly elected: President, Dr. R. Seligman, Aluminum Plant & Vessel Co. Ltd., Wandsworth, London; vice presidents, W. R. Barclay, Henry Wiggin & Co. Ltd., Birmingham; Dr. R. S. Hutton, British Nonferrous Metals Research association, Birmingham; Engineer Vice-Admiral R. W. Skelton, London; members of the council: Wesley Lambert, London; H. C. Lancaster, Woking, Surrey; A. H. Mundey, London; A. J. G. Smout, Birmingham; Prof. F. C. Thompson, Manchester, and F. Tomlinson, Manchester. Dr. Rosenhain then introduced the new president, Dr. Seligman who delivered his presidential address.

After the presidential address, the first paper presented at the morning session was: "The Early Use of the Metals," by T. A. Rickard, Berkeley, California. This was followed by a contribution by D. Stockdale, King's College, Cambridge, entitled: "The Composition of Eutectics."

In the afternoon, three papers presented together for discussion were: "Experiments on the Influence of Gases on the Soundness of Copper Ingots." by N. P. Allen, the University, Birmingham; "Gases in Copper and their Removal," by W. E. Prytherch, National Physical laboratory, Teddington, and "Unsoundness in Bronze Castings," by Edward J. Daniels, British Nonferrous Metals Research association, Birmingham. A lengthy discussion followed the reading of these three papers, in which several practical points of interest were raised by Prof. C. A. Edwards, University college, Swansea, Prof. F. Johnson, Birmingham, Prof. Thompson, and H. C. Dews, Dewrance & Co., London.

The first paper to be presented at the morning session on Thursday, March 13, was the report on the "Investigation of the Effects of Impurities on Copper. Part VI—The Effect of Phosphorus on Copper," by Dr. D. Hanson, the University, Birmingham, S. L. Archbutt and Grace W. Ford, National Physical laboratory, Teddington. The paper described a systematic investigation into the properties of copper containing up to 1.48 per cent of phosphorus, in which the amount of other impurities was kept as small as practicable. The paper was discussed by Dr. Masing, Siemens-Halske Corp.; Berlin; Dr. Rosenhain, W. F. Brazener, Birmingham and Professor Turner.

The next paper was by R. Genders, research department, Woolwich, whose contribution was entitled: "The Aluminum-Brasses." The work comprises a study of the properties of the ductile aluminum-zinc-copper alloys. It is shown that over certain ranges of composition, the presence of aluminum in brass has a beneficial effect in several directions, especially as regards resistance to corrosion and to oxidation at high temperatures. The composition of the alloys can be adjusted to give a wide range of mechanical properties. This paper was followed by a contribution by Dr. C. F. Elam, Cambridge, on "The Diffusion of Zinc in Copper Crystals."

In the afternoon, L. Davies and L. Wright, Metropolitan-Vickers Electric Co. Ltd., Manchester, presented a paper entitled: "Protective Value of Some Electrodeposited Coatings," representing investigations carried out during the year 1929 on a large number of specimens of steel, brass, phosphor-bronze, and copper, which were plated with cadmium, zinc, nickel, and chromium of thicknesses ranging from 0.0001 to 0.002 inches.

R. Lancaster and J. G. Berry, Eyre Smelting Co. Ltd., Merton Abbey, London, presented "A Note on Zinc-Base Die-Casting Alloys." They showed that the effect of adding small quantities of magnesium to a zinc-base alloy, hardened with copper and aluminum, was to bring about a variation in the physical properties. The tensile strength was the greatest with 0.1 per cent magnesium. By increasing the quantity of magnesium, the tensile strength decreased.

Other papers presented to the meeting were: "Macrostructure of Cast Alloys: Effect of Turbulence Due to Gases," by R. Genders; "Atmospheric Action in Relation to Fatigue in Lead," by Bernard P. Haigh and Brinley Jones; "A Note on Metallic Magnesium," by W. R. D. Jones.

Castings Recall *Virginia's* Early History

VIRGINIA, with its rich background of historical settings, is carrying forward a program which will add greatly to the pleasures of the thousands of tourists, who yearly travel the splendid hard surfaced highways that cross and recross the state. Three years ago the state commission on conservation and development undertook the erection of informational tablets along the main highways to inform the traveler of the outstanding happenings in the neighborhood and give history the vitality of actual scenes.

Today, approximately seven hundred markers have been erected, pointing out the many shrines and scenes extending from Jamestown and Williamsburg to Cumberland Gap and Harpers Ferry. These markers carry the visitor back to the early colonial days, to the events that led up to the Revolution, or to the stirring scenes of the Civil war. It is not the purpose of the state commission to erect monuments, but to prepare informational markers, giving a concise account of the events that have transpired at the many locations selected for the markers. Later, those in charge of this work hope to extend the enterprise to include a similar plan for marking the majestic views and notable natural objects which are scattered generously throughout the state.

According to Elmer O. Fippin, executive secretary of the state commission on conservation and development, the marking must be accomplished in such a way that the automobile traveler will secure the information with a minimum of interference with his mode of travel. The inscription must be legible from the car, it must be brief and to the point, and if the work is to be of a lasting character, the tablet must be durable.

After considerable investigation, it was decided that the best results would be obtained by using markers cast of an aluminum alloy or of gray iron. These metals are easy to cast and the inscription may be molded in the metal, thus making it permanent. Experience of the commission has shown that over a period of time, the total cost of tablets made from each of these metals is practically on a par. The first Virginia markers were made of a cast silicon-aluminum alloy and the later markers are of cast gray iron. Both metals are painted in the same colors. The background of the marker is finished in aluminum and the letters are painted an exceptionally light blue.

The tablets are 42 inches wide and 24, 30 and 36 inches high, according to the size of the inscription. A square type letter is used, the proportions being about 1.6 height to 1 width. Experience has shown that the inscription must be brief and clear and that care must be exercised in arranging the letters, words and lines on the tablet. Organization and eternal vigilance is necessary to assure accuracy of statements.

Other states are considering work along similar lines, which probably will create new markets for castings.

YELLOW TAVERN
AN OLD TAVERN THAT STOOD NEAR THIS SPOT GAVE ITS NAME TO THE CAVALRY ENGAGEMENT JUST TO THE NORTH, IN WHICH STUART WAS MORTALLY WOUNDED, MAY 11, 1864.

INDIAN MASSACRE
NEAR HERE WAS THE RENICK SETTLEMENT, RAIDED BY THE SHAWNEE INDIANS IN 1757. FIVE SETTLERS WERE KILLED AND NINE TAKEN CAPTIVE.

Cast Aluminum and Gray Iron Markers Are Used To Point Out the Historic Spots of Virginia

What Others Are Thinking

Abstracts Selected from the World's Foundry Literature

Investigate Aluminum Bronze

Gegossene Aluminumbronzen-I (Cast Aluminum Bronzes), by Dr. W. Claus and Dr.-Ing. F. Goederitz, *Die Giesserei*, Duesseldorf, Feb. 14 and 21, 1930.

The authors carried out a number of tests on three binary and one complex aluminum bronzes. The binary alloys contained 4.5, 7 and 10 per cent aluminum and the complex alloy contained 10 per cent aluminum, 2 per cent manganese, 2 per cent iron, 0.80 per cent nickel, 0.38 per cent tin, and traces of zinc and lead. Test specimens were cast vertically and horizontally in green and dry sand and iron molds. The alloys were melted in a coke-fired crucible furnace and in an oil-fired noncrucible furnace. Some of the conclusions drawn are that the magnitude of the difference in copper content in the horizontal directions decreases from head to foot of the bar; that the copper content increase in the vertical direction from head to foot of the bar appears in all alloys and reaches the highest value in the outer section of vertically cast dry sand specimens; that with increasing cooling speed the magnitude of the segregations is lessened, etc.

Gives Die Casting Alloys

Die Casting, by A. H. Mundey, *The Metal Industry*, London, Jan. 3 and 10, 1930.

In this article the author explains the various classifications of die casting and gives some of the alloys used and their properties. The first section of the article deals with the classification of the branches of the die casting industry gives an outline of the equipment used, and explains the operation of casting machines. The remainder of the article deals with alloys used in that industry including zinc-base, aluminum-copper-zinc, silicon-copper, and magnesium alloys. The author explains the properties of the alloys and some of the uses. The selection of mold material also is discussed.

Study Centrifugal Casting

Scheuderguss und Seine metallkundeiche Untersuchung (Centrifugal Casting and Its Metallurgical Investigation), by M. von Schwarz and A. Vaeth, *Die Giesserei*, Duesseldorf, Feb. 21, 28, March 7 and 14, 1930.

In carrying out the investigation on centrifugal casting, the authors have divided the work into several sections. These include the efficiency of centrifugal casting; a description of the various methods employing the revolving of molds about a horizontal axis, and one method using a vertical axis; an investigation of phosphorus-rich sand casting; properties of unannealed centrifugal castings; annealing of centrifugally-cast iron, and segregation and defective castings. Some of the conclusions of the authors are that fluid friction permits the formation of uniform wall strength in centrifugally cast pipe. For the most favorable rotation speed there is a definite relation between the weight per square centimeter of chill surface to the centrifugal pressure per square centimeter of chill surface. For phosphorus-rich commercial castings a minimum silicon content should be decided for workability. With similar charge make-up, increasing phosphorus content decreases the specific gravity. A heat treatment of 4 hours at 760 to 780 degrees cent. for centrifugal castings with wall thicknesses from 0.20 to 0.25-inch and 1.33 per cent phosphorus, completely eliminated combined carbon.

Describes Cleaning Methods

L'Evolution de la Technique de la Pieces de Fonderie. (The Cleaning of Castings). by Paul Thome, *Bulletin* de l' Association technique de Fonderie, Paris, December, 1929.

In introducing his subject the author states that a great deal can be done in mold preparation to decrease cleaning costs. Quality of sand and pouring temperature have much to do with the ease or difficulty of sand removal in the cleaning department. Various methods of cleaning including hand, metal brushing, tumbling, hydraulic, acid and sandblasting then are described. The author gives the application of the various methods of cleaning and the advantages and disadvantages of the methods.

Speaks Foundry Technique

L'Evolution de la Technique de la Fonderie; Les Tendances et les Necessites Actuelles (The Evolution of Foundry Technique: Present Tendencies and Necessities), by J. Leonard, president of the Association Technique De Fonderie de Belgique. *Bulletin* l'association Technique de Fonderie de Belgique, Liege, February, 1930.

This article is interesting inasmuch as it gives a resume of the organization of scientific investigation into foundry practice in Belgium, Great Britain, France and Germany. The author points out that it is only since the war that the casting of iron has been studied scientifically and intensively. Before 1913 the molder was the keyman, and the trade depended upon the molder's skill and experience. Now the use of mechanical equipment is the importane consideration from the standpoint of production, while cast iron only can maintain its status against competing metals and processes if its behavior and possibilities are investigated properly. The article shows that leading metallurgists in all countries are devoting considerable time and thought to the study of the various properties of cast iron.

Comments on Jobbing Molding

Some Aspects of Jobbing Molding, by S. Southcott, *Foundry Trade Journal* London, Feb. 20, 1930.

European molding practice differs in many ways from that used in America. However, it should be interesting to follow some of the practices used in European foundries. The majority of this paper deals with the molding of a 28-inch cylinder. The fore part of the article is devoted to a discussion of gating methods and pouring basins. The author also comments on the feeding or pumping of castings.

The author describes the molding of a cylinder and steam chest combined. He gives the dimension and some of the points that must be taken into consideration to secure a sound casting. The description includes the methods used both for molding and core making and special reference is made to the head ring and the steam chest cores. He also describes the method used in molding a distributor for a blast furnace.

The paper was presented at the Cardiff, Wales, meeting of the Wales and Monmouth branch of the Institute of British Foundrymen. The paper evoked much discussion on gating methods used in the production of cylinders and piston rings, some of which is included in the article.

Discusses Nickel Alloys

Nickel Casting Alloys, by J. McNeil. *The Metal Industry*, London, March 7 and 14, 1930.

Many alloys both ferrous and nonferrous contain nickel. The uses of the alloy in both classes of metals are discussed in this paper, the majority of which is devoted to nonferrous alloys including nickel silvers, high tensile nickel brasses, complex nickel brasses, nickel bronzes, high nickel content bronzes and nickel-copper alloys. Nickel chromium and nickel-chromium-iron alloys, miscellaneous nonferrous nickel alloys and nickel steel castings also are discussed.

Foundry practice for various alloys is given and includes such information as melting points, melting practice, fluxes, deoxidizers, and pouring temperatures. The structures of the alloys are described and in some cases, general classes are subdivided. Physical properties of the alloys including yield points, maximum stresses, elongations and brinell hardness numbers are given. The use of the alloys are given in several cases.

No effort has been made to give foundry practices used with ferrous nickel alloys but improvements in heat and corrosion resistance are noted and physical properties are given. Discussions of the paper by members of the co-ordinating committee at Birmingham, England, where the paper was presented, is included at the end of the article.

The FOUNDRY Family Photograph Album

Upper Left

SCOTT TURNER

Bureau of Mines, Washington

Upper Right

E. R. WOLVERTON

Bloomsbury Graphite Co., Bloomsbury, N. J.

Lower Left

C. A. HINES

Vulcan Plow Co. Mansfield, O.

Lower Right

H. EDWARDS

O. M. Edwards Co. Inc., Syracuse, N. Y.

HINTS FOR THE CORE ROOM

(*Continued from Data Sheet No.* 808)

A small amount of glutrin will neutralize the lime in a sand containing lime.

Cores for aluminum and steel which must collapse readily after pouring to prevent shrinkage cracks in the castings often are made with rosin or flour bond as weak as is possible and still allow the cores to be handled.

Cores which must be left in a mold for a considerable time before pouring should be made from a clean sharp sand free from clay and other moisture absorbing constituents. Pitch and oil are the best binders to use under such conditions.

Refractory Coatings, Washes, etc.

A wash of 1 part water glass and 2 parts water is used for cores

DATA ON CORE BINDERS

Binder	Specific Gravity (Approx.)	Weight per Gal. Pounds	Baking Temperature Deg. Fahr.	Binder Destroyed Deg. Fahr.	Baking Speed Comparative
Linseed oil	0.93	7.8	450-500	600-700	Slow
Core oil	0.90	7.5	450-500	600-700	Slow
Wheat flour	0.60	4.5-5.5	325	500-600	Fast
Corn flour*	0.45	2.5-4.5	325	500-600	Fast
Dextrine*	0.47	3.9	350	500-600	Fast
Clay*	1.0-2.0	8.5-17	300	2000-3000	Fast
Molasses*	1.3	10.5-11.5	250	400-500	Fast
Hydrol*	1.4	11.7	250	400-500	Fast
Sulphite Solution	1.25	10.5	350	600-700	Fast
Dry sulphite	0.6	5	350	450-500	Fast
Pitch	0.46	3.9	350-400	500-600	Fast
Oilless Binder	0.47	4	350	500-600	Fast
Rosin	1.07	9	325	600-700	Fast

*These binders seldom are used alone.

in bronze, heavy cast iron, and steel castings where burning in, penetration, etc. are serious problems.

Cores of heavy sections which burn in badly may be wrapped in asbestos paper or asbestos may be put in the sand mix.

Fire clay and silica flour are more resistant to high temperatures than other binders and are therefore desirable in mixes and washes for heavy section castings of either cast iron or steel.

A good coating for brass and bronze cores may be made by making a paste with a good grade of plumbago and molasses water, kerosene, or water glass. This paste should be rubbed on by hand and then dried thoroughly.

(*Continued on Data Sheet No.* 810)

HINTS FOR THE CORE ROOM

(*Continued from Data Sheet No.* 809)

To prevent penetration or cutting in cores for brass and bronze castings they should be coated with a good grade of core wash (talc, plumbago, or silica wash). When used with heavy sections it may be necessary to put on several coats and care taken to dry each coat thoroughly before the next coat is put on. This wash may be made with water, molasses water, glutrin, kerosene, or water glass, depending on the wash used and the local practice.

A wash recommended for large cores consists of 1 part water glass, 4 parts water, and 4 parts good grade plumbago.

Fire clay is desirable in dry sand work because its bond property holds up at high temperatures. It will hold up and not collapse till after the gases formed are forced out of the mold.

Skim gate cores should be made hard and from a refractory mixture

DATA ON CORE BINDERS

Binder	Hardness of Cores Comparative	Moisture for Tempering % by Volume	Machine Mixing time Minutes	Bond Ratio by Volume	Removal from Castings Comparative
Linseed oil	Hard	8	5-7	1-40-120	Good
Core oil	Hard	8	5-7	1-40-100	Good
Wheat flour	Medium	10	7-10	1-12-20	Good
Corn flour*	Medium	10	6-10	1-25-50	Good
Dextrine*	Medium	8	7-10	1-10-20	Good
Clay*	Frail	8	7-10	.....	Fair
Molasses*	Frail	7	5-8	.....	Good
Hydrol*	Frail	7	5-8	.....	Good
Sulphite solution	Hard shell	3-5	7-10	1-50-100	Good
Dry sulphite	Medium	8	7-10	1-50-100	Good
Pitch	Hard	7	5-7	1-15-25	Hard
Oilless binder	Hard	7	5-7	1-35-40	Fair
Rosin	Soft	7	5-10	1-15-20	Good

*These binders seldom are used alone.

to withstand abrasive action and the high temperature. Fire clay and silica flour are recommended.

Scabbing, Flaking, Cutting, etc.

Scabbing and flaking often are caused by cores that are too hard or too close (do not vent freely).

A strong well baked core may burn in or cut more readily than a rather weak underbaked core properly vented under certain circumstances. Where a core is subjected to the heat and abrasion of a considerable quantity of metal, the binder breaks down more quickly in the well baked core allowing the metal which is still liquid to burn in and cut. This means

(*Continued on Data Sheet No.* 811)

THE FOUNDRY DATA SHEET, APRIL 15, 1930

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Questions & Answers on FOUNDRY PRACTICE

GRAY IRON

Should Check Machine Shop Practice

QUESTION

We are sending you a sample of our gray iron from which we cast gears and other castings from ½ x 2 up to 8 inches for lawnmower parts. All departments of our organization think that this iron is good except the gear department which complains that it is too hard and causes extreme wear and breakage of tools. The tools are made of the best grade of steel that can be obtained. Our laboratory gives the following analysis for this iron: Silicon, 2.40 to 2.50 per cent; sulphur, 0.075 to 0.090 per cent; manganese, 0.50 to 0.60 per cent, and phosphorus, 0.525 per cent. Can you tell us how to rectify our trouble without decreasing strength in the other castings?

ANSWER

From the question as stated we are unable to determine whether you mean castings ½-inch thick x 2 inches diameter to ½-inch thick x 8 inches diameter, or otherwise. The thickness of the casting is most important. The thinner the section thickness, the harder the iron for the same analysis. Total carbon also would be a good figure to include in your analysis. The sample submitted has a clear gray fracture with no indication of mottle or chilled spots. It files and drills readily. We assume that the total carbon is 3.50 per cent or thereabouts. If it is around 3.20 per cent, the metal may be rather tough.

If your castings have chilled edges, they will ruin nearly any tool steel. However, the sample does not indicate any trouble of this nature. Rigidity of tool and set-up are essential to best tool life. Chatter is extremely detrimental. Proper adjustment of feeds and speeds play a great part in obtaining satisfactory machinability and freedom from broken and burned tools. While some improvement might be obtained by the use of slightly higher silicon, and phosphorus somewhat lower, it appears that the main trouble lies in the machining operations.

THIS department covers all problems relating to metallurgical, melting and molding practice encountered in making steel, malleable-iron and gray-iron castings. Questions submitted by bonafide subscribers to this department will be answered by members of the editorial staff of The Foundry, supplemented where occasion requires by the advisory staff whose personnel is as follows:

John H. Hall—Cast Steel
H. A. Schwartz—Malleable Cast Iron
J. W. Bolton—Gray Cast Iron

All questions should be addressed to The Editor, The Foundry, Penton Building, Cleveland.

Q & A

Recovers Iron Borings

QUESTION

During the manufacture of our product we accumulate a large quantity of cast iron borings which we have been selling. However, we are wondering if we could remelt these in our cupola. Can you give us any suggestions on how to handle them?

ANSWER

Borings are melted in a variety of forms. One method is to briquet them either with or without a binder and with and without pressure. Another method is to pack the borings in sheet steel containers similar to stove pipe lengths holding about 50 pounds. The ends of the containers are sealed with sheet steel heads which are crimped into place. Hurst in his book, "Melting Iron in the Cupola," gives much information on the methods employed, and the results obtained by using a certain proportion of borings in each iron charge. The main points to watch are the distribution of the boring briquets or containers in the cupola, see that you have good cupola practice, and that you do not add too large a quantity of borings.

Q & A

Wants to Increase Steel

QUESTION

Our foundry superintendent visited a large automotive foundry recently where they claim to use 35 per cent steel scrap in their charges and melt 600 tons of metal a day. We are using 10 per cent steel, but if we go beyond that amount we have difficulty from hard spots. We are using a rocking type, indirect arc, electric furnace and we would like to use more steel scrap as it seems to prevent porous spots and leaks in our small air compressor cylinders. Carbon is added in the furnace.

ANSWER

The automotive foundry referred to is able to use 35 per cent steel scrap because cupolas are used for the melting units. During the process of melting the scrap picks up considerable carbon from the red hot coke. Even when 100 per cent steel scrap is used the total carbon in the molten iron runs around 3 per cent. However, your conditions are different, and you would find that even though you had plenty of graphite or petroleum coke mixed with all steel scrap in your electric furnace that it would melt down with only about 2.50 to 2.75 per cent carbon. By increasing the temperature of the furnace, rabbling in the carburizing agent, and inserting green wood poles into the metal to create a boil, you would be able to increase the carbon content.

However, this would take considerable time and experimental work to determine the period of rabbling and insertion of the poles. Therefore, instead of trying an all steel mixture, another expedient should be tried. It

will entail some experimental work on your part. Increase your steel to 35 or 50 per cent adding either graphite or petroleum coke with the charge. This material will be better as it is heavy. Melt the charge and when molten, remove any slag that has accumulated. Then cover the surface with graphite or petroleum coke and raise the furnace temperature as high as possible. Rabble the carburizing agent well so that it comes into intimate contact with the bath. Then add a sufficient amount of ferromanganese and ferrosilicon broken up into small pieces, to bring these elements to the desired point.

Close the furnace so that the metal will become good and hot, and the ferroalloys will have opportunity to become well mixed with the bath. Since the compressor cylinders you refer to are small, the section is comparatively light, and your final analysis should be arranged with this in mind. Therefore, we suggest that you try a silicon content from 2.50 to 2.75 per cent; sulphur as low as possible; manganese, 0.70 to 0.90 per cent and phosphorus, under 0.30 per cent.

The higher silicon content with lower total carbon content should give you a denser iron than that obtained from the cupola. However, if you wish to experiment with alloys, you might try adding about 1 per cent nickel to your mixture. This may be added as metallic nickel, nickel-chromium bearing pig iron, or as an alloy of nickel and chromium. Firms supplying these materials may be found in the advertising pages of THE FOUNDRY.

Q & A

Has Low Phosphorus

QUESTION

We have an order for some ingot molds for a steel plant, and would like to have some information on the best analysis for castings of this nature. The average size of the ingots will be about 6 inches square and 4 feet high. Would you advise pouring the molds very hot?

ANSWER

Ingot molds generally are made from bessemer pig iron which is low in phosphorus and silicon, if the best results are to be expected from the molds. A pig iron recommended for this type of work contains 2.00 to 2.25 per cent silicon; under 0.025 per cent sulphur; 0.15 per cent or under phosphorus, and 1.00 to 1.50 per cent manganese. This pig iron melted in the cupola will give an approximate analysis as follows: Silicon, 1.75 to 2.00 per cent; sulphur, 0.08 per cent; phosphorus, 0.15 to 0.17 per cent, and manganese, 0.80 to 1.20 per cent.

The main essentials are to hold the phosphorus and sulphur to a low point, and for this reason many ingot molds are poured with metal direct from the blast furnaces. In this case the silicon will run lower than that given after cupola melting. Since the silicon and phosphorus content of the metal is lower than that used for castings of similar section, it may have to be cast hotter than usual. However, the colder the metal can be cast and obtain solid castings, the smoother the surface will be on the inside next to the well-blacked core.

GENERAL

Piston Rings Show Dirt

QUESTION

I am making piston rings in green sand ranging in thickness from ½ to 2 inches and in diameter from 4 to 54 inches. The average length is 10 inches. I am enclosing a broken section in which you will note a defect that is common to many castings. This part taken from a point about half way between the top and the bottom of the casting seems to be saturated with some kind of foreign material. Do you think it is graphite? We use a good grade of pig iron and scrap with steel additions in the heavier rings. Iron is poured in a runner box on the cope connecting through a central sprue with a number of branch gates at the joint designed to fill the mold uniformly.

ANSWER

Assuming that you are more interested in a remedy than in a discussion of the causes of the defective area in the piston ring casting, we shall consider that point first and refer later to the probable causes of the trouble with alternative methods for overcoming them. Make the mold in open sand and pour the iron either through a strainer core over the top or from an ordinary basin on the outside. Have a man standing by with a ¼-inch rod. This man must watch the rising iron and when he notes any scum forming on top, he touches it with the rod so that it continues to float. This method is simple and practical. It is practiced extensively in pulley shops and insures clean, solid castings, provided, of course, that the sand is rammed properly and is not hard or damp enough to cause the iron to *boil*.

Under your present method the iron has to travel for a considerable distance in channels made by the molder, first in a basin on top the cope, then down through a sprue and then spread out through a number of flat, shallow branches. Even where the greatest care is exercised, the flowing iron is bound to collect a certain amount of loose sand and dust which it carries into the mold. This slush on account of its lighter specific gravity remains on top of the body of iron in the mold. Sometimes it continues to ride on top until the mold is filled. Usually, it sticks to the wall of the mold either directly or through a film which quickly forms on the surface of the rising iron. Liquid iron flows through, around and over it and in the ordinary casting its presence never is detected. Piston ring castings are different. They are cut into thin sections and any defective area in the iron inevitably is disclosed. The obvious remedy is to introduce the iron as simply and quickly as possible, preferably through a strainer core on top of the mold.

Sometimes with the runner, gates and iron perfect, hard or damp sand will produce a defective area in one of these castings. Steam from the inside or outside wall of the mold will cause the iron to boil. The boiling action creates a scum which floats on the iron in some instances and in other instances becomes anchored to the mold walls. With exceedingly open sand the precaution may be omitted, but with most of the ordinary grades of molding sand, the walls of the mold inside and outside should be vented with a wire before the pattern is removed. However, as previously stated, the best way to make these castings is to mold and pour them in open sand molds where the rising iron may be watched and where the scum, if any, may be kept floating.

Q & A

Pour Iron Continuously

QUESTION

I am thinking of introducing a continuous pouring system into a small jobbing shop where a miscellaneous line of small castings is made, including plow points, building castings, grates, municipal, highway, cotton mill and other castings. I shall appreciate information on the kind of machinery required, how the molds are arranged on the machine and if the work can be done successfully.

ANSWER

Continuous pouring is practised extensively and successfully by practically all the large foundries engaged in the production of immense quantities of duplicate parts. Conditions in these plants are vastly different from those which obtain in small jobbing shops. The method probably could be adapted to meet local conditions, but we doubt if the change from the present method would confer

any advantage in a jobbing shop.

Details of construction and operation vary in the different plants, but the basic method is the same in all. The molds are made on molding machines, placed on a conveyor, poured while passing a given point and shaken out a short distance farther along. The castings are taken one way, the flasks another and the sand is returned to a rejuvenation station where it is tempered and once more placed in use. Obviously this method involves the installation of a considerable amount of mechanical equipment and its success is based to a great extent on the fact that the molds are all alike. Design and installation of special equipment to handle a widely varying line of flasks incident to the ordinary day's work in a jobbing shop, would prove a difficult problem. Even more difficult would be the arrangement of the sequence of molding to fit in with the melting schedule. Iron designed for plow points is not suitable for machinery castings. Therefore these molds would have to be made in considerable numbers and segregated so that they might be poured from the special mixtures.

If you are contemplating the installation of iron molds, the problem assumes an entirely different aspect. A considerable amount of experimental work has been done in this field and we suggest you get in touch with firms prepared to design and supply molds for the purpose, instead of wasting time and money in trying to solve the highly complicated problem by yourself. The subject of permanent molds has been discussed frequently in THE FOUNDRY, and if one feature has been stressed more than another in these discussions, it is that the field is no place for an amateur.

Q & A

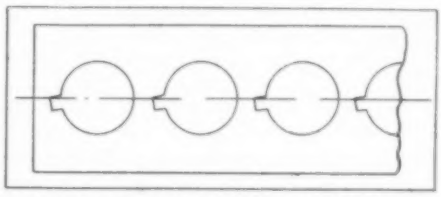
Smooth Cores Desired

QUESTION

We are making a gray iron sprocket wheel with a hub 2 inches deep to fit on a 1-inch cold rolled steel shaft. The wheel is held in place with a ¼-inch key. Up to the present we have used a ⅞-inch round core and afterward reamed the hole to a slip fit and cut a keyway. We want to eliminate all the machine work and will appreciate a formula for a core that will leave a smooth surface, and a keyway that will be sufficiently accurate in dimensions.

ANSWER

We doubt whether you can get a sand core of any kind that will yield a hole as clean and accurate as one that has been reamed. Even if you succeeded in producing an experimental core it is extremely problematical whether you could produce a large number of similar cores on a production basis. Variations due to rapping the corebox, drying speed, core mixtures and other factors incident to the process of coremaking, will be reflected in the cores to the extent of a few thousandths of an inch. However, in the event that a fairly loose fit is permissible, a suitable core may be made either from green or dry sand. If a slight taper is allowable the pattern may leave its own core. Where the core has to be perfectly straight, green sand



CORE BOX IS SPLIT ALONG CENTER LINE

may be rammed in a corebox in the usual manner and the cores may be handled with safety. The sand for this purpose must have a fine grain and be highly refractory. Otherwise the surface of the hole in the casting will be rough. A dry sand core mixture that has been found satisfactory for making small cores that produce a smooth surface is made up of Michigan City sand 70 parts by volume, sandblast dust 30 parts, water 8 parts, raw linseed oil 2 parts. The cores are rammed on end in a gang box as shown in the accompanying illustration.

MALLEABLE

Malleable Castings Warp

QUESTION

I am sending to you two small malleable castings which have warped and I would like to know how to overcome this. In packing these castings in the boxes, a layer of slag packing material is placed on the bottom of the pot. Then a tier of four castings without packing between is placed on this layer. The tiers are separated from the pot and each other by a ½-inch space filled with packing material. Then a layer of packing material is placed on top of the tiers and another tier of four castings built up, and so on until the pot is filled within ½-inch from the top. This space is filled with packing material. Steel plates are placed between the pots which are rapped with a hammer to settle the packing.

Pyrometers on the ovens have been checked and the operating temperature is 1480 degrees Fahr. in the coolest part of the oven which is held for 60 hours. The temperature on top of the stack (three pots high) is 1640 degrees Fahr. measured at a point 6 feet in through the front of the oven. The warpage occurs in the bottom pot of the stack in front of the oven as well as in any other location or position. Sometimes the oven comes out all right, and other times there is some warpage with apparently the same conditions.

ANSWER

Your precautions apparently should be adequate. However, the possibility is suggested that, since the castings have to grow during the anneal, it may be that if the packing in which they are buried is packed too tight in some places and loosely elsewhere, the castings may warp in the direction of least resistance. Try packing the castings as loosely as possible so that expansion may occur without restraint.

STEEL

Has Core Trouble

QUESTION

I am enclosing the sketch of a steel casting with which I am having trouble with the core. The sand mixture for the cores consists of 7 parts of steel sand, 3 parts of fireclay and 1½ parts of linseed oil.

ANSWER

Examination of the sketch shows a large mass of steel surrounding a comparatively small core, and while you do not state what the difficulty is, we assume that you are having trouble with the steel penetrating the core. When small cores are surrounded by a heavy mass of steel, the steel actually forces its way in between the grains of sand to such an extent as to convert the core into a sort of sandstone. The steel supplies the binder which holds the sand grains together. Analyses of specimens of hard cores of that type have shown an iron content of 49 per cent. The remedy for the trouble consists in using a core sand mixture as dense as possible, and giving the cores a heavy coating of fine material. The fine material will to a great extent prevent penetration of the steel into the core.

In general the mixture should consist of steel sand, silica flour, clay and a core binder other than oil. The cores after drying should be given two or three coats of silica flour wash. The wash should be made quite thick and dried on thoroughly. Care should be exerted not to break the wash coating. One foundryman has substituted successfully for the silica wash, a coating made from the material used for wrapping steam pipes (magnesia). He ground the material finely and made a slurry which was used as a wash.

Problems in Nonferrous Founding

By Charles Vickers

Changes Brass Mixture

We would like to learn if the following formula for composition brass castings would produce reasonably tight castings. The formula is 83 per cent copper; 4 per cent tin; 2 per cent lead and 11 per cent zinc. We found the castings to be spongy when we used the formula, leaking through the entire casting at 15 pounds pressure. The castings are fairly large, about 30 pounds in weight each, with walls 3/16-inch thick. They are used for under water lighting in swimming pools.

We note that in the formual given the tin has been put at 4 per cent and the lead, at 2 per cent, which is a reversal of the usual proportions of the alloy. Therefore we believe that a mistake has been made in writing the figures. The alloy when used for plumbing castings is as follows: 83 per cent copper; 11 per cent zinc; 4 per cent lead, and 2 per cent tin.

The formula as revised has been used extensively for moderate pressures, such as those of city water systems, and it seems to have given satisfaction. Its greatest drawback, as we view it, is due to its yellow color when machined. It looks like yellow brass, but it really is not in that class. Therefore there is no particular advantage in using it in preference, to a yellow brass containing around 18 per cent zinc, such, for instance as 76 per cent copper; 18 per cent zinc; 3 per cent tin, and 3 per cent lead. This latter is a formula recommended by the late Jesse L. Jones, for low-priced castings.

If a red brass is desired, we suggest the following formula: 85 per cent copper; 6 per cent zinc; 5 per cent lead, and 4 per cent tin in place of the 83-11-4-2, copper-zinc-lead-tin alloy. The chances are greatly in favor of a high percentage of leakers with the majority of red brasses, if they are cast minus some sort of a deoxidizer. In such case they will contain oxide films along the crystal boundaries which form paths through which gases and liquids under pressure can escape. Many founders use phosphor-copper, in the proportion of 1½ ounces to each 100 pounds of brass produced in the foundry.

Q & A

Bronze Gears Pit

We have been casting gear blanks and also toothed gears for the past 25 years and have never had trouble due to cutting of the bronze until some four months ago, and since that time we have experienced much trouble of this kind. The teeth pit badly as though some kind of a grinding or cutting action had taken place. The gear is part of an elevator hoist and it runs in an oil bath, and is never permitted to run dry. The analysis of the bronze gave 87.40 per cent copper; 10.35 per cent tin; 0.49 per cent lead, and 1.72 per cent zinc. The lead is accounted for by the use of scrap pipe coated with tin. Analysis of the worm forgings showed them to be lower in carbon than those used in the past during which time we never experienced any trouble though we used the same alloy as at present.

The analysis of the bronze shows that it was intended for the alloy 88-10-2 copper-tin-zinc, which is frequently used for gears of this type. This mixture should run against hardened steel, so probably the worms are too soft and that is the cause of the trouble. As it may be difficult to convince the customer that this is likely the case it would be advisable to change the alloy, substituting the standard gear bronze for the 88-10-2 alloy.

This alloy consists of 87 per cent copper; 11 per cent tin, and 2 per cent of phosphor copper, containing 15 per cent of phosphorus. This is known as Stone's gear bronze and it is the alloy used by automotive engineers. If this alloy gives no better service than the 88-10-2 mixture, it will be evident that the source of the trouble lies with the steel worms and not with the bronze gears the foundry is now supplying as in the past. This gear bronze must run with a worm of hardened steel, or alloy steel.

Brass Is Too Soft

We are making an alloy of 50 per cent copper and 50 per cent lead using sulphur to hold the lead from segregating. Our brinell number is only 12 and we would like to increase it to 15 or 20. If we add a small amount of nickel can we obtain the desired results without destroying the wearing and lubricating qualities, and would it cast the same as the above mixture?

The effect of adding nickel would be similar to adding copper to the alloy, which in effect would be to decrease the lead. It is possible that 55 per cent copper to 45 per cent lead would give you the desired properties, but if not quite right the lead could be still further lessened and the copper correspondingly increased until the alloy you want was arrived at. Addition of nickel would have no effect in *holding in the lead.*

However, tin could be added. Adding one per cent tin in place of one per cent lead would make a harder alloy or admixture. However, the addition of tin to these high lead metals, increases the difficulty of *holding in* the lead. An admixture of 60 per cent copper, 38 per cent lead, and 2 per cent tin, has a brinell of around 29 but it will cause more trouble in making homogenous sand molded castings, than the 50-50 mixture, such as you use. All these admixtures of lead and copper, are susceptible to iron additions. Therefore, use caution in the use of iron stirrers and other tools. The effect of iron is manifested in the presence of black slag in the castings.

Q & A

Iron Causes Specks

We are making piano pedals of aluminum yellow brass which after being polished show defects in the form of minute black specks which mar the finished surface. The castings are made from part scrap and part ingot. They are gated at one end and poured at about 2150 degrees Fahr. The molding is by machine using an aluminum plate. The castings before they are polished do not show any of the spots, and we presume they are

under the skin. We are sending a casting as an illustration, and will be thankful for anything you may suggest as a remedy.

Analysis of the black specks shows that they consist of iron, or a compound of iron. When the castings are filed with a dead smooth file, the specks break out and leave clean holes about the size of a pinpoint.

When dissolved out without attacking the brass, a positive reaction for iron is obtained both with ferrocyanide of potassium, or with ammonium thiocyanate. This proves that the specks are iron, or as before remarked, probably a compound of iron. We do not know the origin but the scrap should be scrutinized more closely and visible iron removed, as the less added to the melt the better. To prove whether this diagnosis is correct or not, pour a heat of all new metals and carefully segregate the castings so they do not get mixed with the regular heats, then polish them, and no black specks will develop.

We know of no certain method for removing the iron from the melts.

It might be possible to effect this by superheating the metal for a few minutes after it is ready and using a flux of borax on the surface, the idea being either to bring the insoluble iron to the surface where it would be held by the borax, and later skimmed off, or to get the iron to dissolve in the brass. We merely offer this as a suggestion and do not know whether or not it will work to accomplish the desired result.

Readers Comment

Note—Material appearing under this head does not necessarily reflect the opinion of The Foundry or of its editors.

TO THE EDITORS:

I am pleased to see so much interest aroused when an educational institution is deciding whether or not it will continue to offer a course in foundry practice, as is expressed in the article on "Foundry Training" in the March 15 issue.

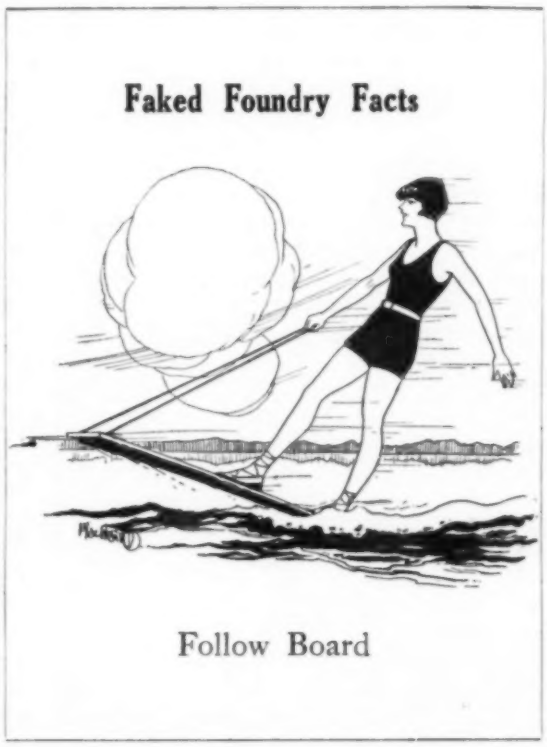
I believe that the foundrymen are at least partially responsible for a condition of this kind. I have been connected with the shop laboratories at the University of Illinois for five years, and I have seen but little interest taken by foundrymen in what we teach the students in our foundry laboratory. Foundrymen will go long distances to see a football game, but will not take the trouble while on the university campus to even take a look at the foundry laboratory. The instructors of foundry practice need encouragement and ideas from industry. If foundrymen would show in some manner that they were interested in what the universities are doing, I am sure it would inspire the instructors of foundry practice to do better work and put more enthusiasm into their work.

Foundry men are now on the defensive. They are compelled to prove that welded steel is not going to replace castings. If foundrymen had employed engineers and technical men to improve their product and cut the cost of production as they are today, they would not be on the defensive.

I believe that the American Foundrymen's association through the efforts of C. E. Hoyt and R. E. Kennedy do a great deal to bring foundrymen and engineering colleges closer together. I believe that the exhibit of the work of educational institutions at the convention in Cleveland will help to bring about a better understanding between foundrymen and educators and I am hoping to get suggestions and help to improve our instruction from it.

I also think THE FOUNDRY has done its share to help and encourage the educational institutions and this article referred to will be of great help.

C. H. CASBERG,
Manager Shop Laboratories.
University of Illinois,
Urbana, Ill.



Omits Nonferrous Study

TO THE EDITORS:

I have just glanced through the paper on "Foundry Training," as given on page 80 of the March 15 issue of THE FOUNDRY. This is an interesting discussion and particularly it is interesting to note the differences of opinion between the various practical men. There are two things that strike me as being unusual in this paper. One is that the subject of nonferrous metals, many of which are cast, is not included and further, that the study of these metals from a metallurgical viewpoint does not seem to be referred to. The second point is that the influence on design of the general, but rather elementary, knowledge of cast metals as well as other processes, such as making stampings, forgings, etc., seems to be overlooked. Certainly, all universities teaching engineering students offer courses in design. It, therefore, seems to me that the students in design should have an acquaintance with the process by which the part is to be made. A paper I gave dealing with this subject at Purdue university last summer before the summer school for teachers of mechanical engineering, has just been published in the February *Journal of Engineering Education*. In this study, however, information and opinions were obtained, not from practical men, but from various university staffs. I am very glad, indeed, to see that you are devoting this space to the subject of university training. I believe the general tendency of the various university staffs is to belittle such training as shop work.

O. W. BOSTON,
Director, Department of Engineering Shops.
University of Michigan,
Ann Arbor, Mich.

Wants Other Viewpoint

TO THE EDITORS:

Thank you for sending me the March 15 issue of THE FOUNDRY, containing my reply to the letter sent out by Prof. C. W. Beese, head, department of industrial engineering, along with replies from other representatives of the foundry industry.

As an engineering graduate of the University of Illinois, it would be interesting to me to have your own personal viewpoint on this pertinent question which, from my contacts with engineering schools, is a vital one to them at the present time.

As a matter of fact, it seems to me it is a disgrace to the industry to have some of the larger engineering colleges making such a fiasco of the so-called foundry laboratory training. It appears to me from reading the comments of many of the writers that they are of the same opinion as myself.

It has occurred to me to suggest that it would be quite possible for THE FOUNDRY in its contact with engineering schools, to present an unbiased survey of the status of the various so-called foundry training facilities of the different engineering universities and colleges in the United States. If this could be done, it would possibly bring about a consciousness on the part of the engineering universities of the necessity of a complete renovation in their equipment and methods of teaching.

F. A. LORENZ JR.
General Manager.

Indiana Harbor & Pittsburgh Works, American Steel Foundries.

Makes Plaster of Paris Core Dryer

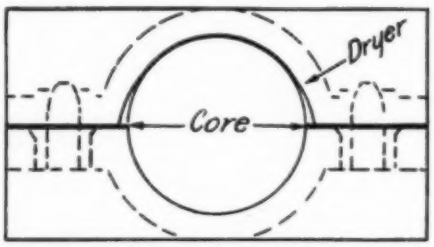
By H. S. Clark

It is strange that there are so many inconsistencies in the foundry industry. Foundrymen sometimes cannot see extremely apparent defects not only in their foundry practice but also in the care of their equipment. As an illustration take a certain brass foundry of the middle west. It had numerous bushing patterns that were scattered from one end of the foundry to the other. These finally were gathered together and placed in the pattern storage room in order of their outside diameters. They also were entered in a pattern book. After that it was no task to look over the book to see what pattern was required for the desired bushing.

Another example was the large steel foundry which used great care in making of numerous flat cores about two inches square. After they were baked they were laid carelessly in a box and trucked to the molding floor over an uneven plate walk. The mishandling and the rough path resulted in broken corners and an inconvenient grinding and chipping job. It was necessary to spend from two to five minutes on each casting to clean it. These cores still are mishandled and the steel plate path is uneven.

One foundry cast a lug on the side of a journal box. This lug then was cut off in the machine shop. This lug often resulted in poor castings, but it took over a year for the foundry foreman to do a little investigating and find that the undesirable lug was a mistake by the patternmaker.

The author recently visited the foundry of a large manufacturer and



A FRAME HOLDS THE PLASTER DRYER PATTERN IN POSITION

was amazed to note the time that was wasted in setting cores. A certain amount of time is required to set cores carefully, but in this case the operation had been carried to the extreme. Core dryers used in that plant fitted the cores so perfectly that they could have been used as core boxes. Between three and four hours were spent in setting a single core. That is entirely too much time for the operation.

The author's experience with dryers for plumbing fixtures with metal thickness of approximately 5/64-inch leads him to say that dryers which support a core and do not inclose it give excellent service. Careful work on the master pattern of the core dryer should result in little work by the metal patternmaker.

The accompanying illustration shows one method of constructing a core dryer. Make a plaster of paris core from the finished metal core box. Lift the side of the core box that contains the holes, leaving the plaster of paris core resting in the pin side or cope. Shellac the plaster of paris core and, when it is dry, oil it. Make a frame around cope core box to hold the plaster of paris dryer pattern. Pour in plaster of paris, shake the mold to expel air. An hour later remove frame and plaster of paris casting. Remove excess plaster with band and coping saw. Gouge and scrape the plaster so that the shrinkage will not bind the core. See that there is considerable clearance on the sides of the dryer, around fillets and corners as the dryer need only bear on part of the top of the core before it is turned over. Shellac plaster of paris dryer pattern and send it to the foundry.

Stresses Need for Study of Castings Uses

Maj. R. A. Bull, director, Electric Steel Founders Research group, gave an interesting practical talk at the April meeting of the Chicago Foundrymen's club, stressing the necessity of modifying procedure along practical and engineering lines to meet competitive conditions. He urged a study of the castings market and warned steel, gray iron, malleable, and brass and aluminum foundries of the danger in insisting upon the introduction of their specialized products where not suitable for best results. Major Bull stressed the view that foundries should take an offensive rather than a defensive position, and urged that foundrymen regard themselves as manufacturers or makers of castings. The May 1 meeting will be addressed by J. G. Pearce, director of the British Cast Iron Research association, Birmingham, Eng.

Book Review

Gmelins Handbuch der Anorganischen Chemie, Eisen, Teil A-Lieferung 1, paper, 224 pages, 6¾ x 10 inches, published by Verlag Chemie, Berlin, Germany, and supplied by THE FOUNDRY, Cleveland, for $8.85 plus 15 cents postage.

This volume constitutes one of a series of the eighth edition of Gmelin's monumental work on inorganic chemistry. It deals with iron and is one of three volumes devoted to the subject. The book is divided into three parts, of which the first deals with the historical phases. The historical section is presented in the form of a bibliography of literature on the subject. This is followed by a chapter on the occurrence of the various forms of iron, and the location of iron deposits in Europe, America, Asia, Africa and Australia. The last chapter in the volume is devoted to pure iron, and includes data on its manufacture by electrolytic methods and by chemical means. It also describes special forms of pure iron and its properties.

G. E. Madden, Allegheny and Center streets, Pittsburgh, has been appointed Pittsburgh representative for the Shanafelt Mfg. Co., Canton, O., manufacturers of foundry flasks.

Bill Does Not Favor Welding a Bell

By Pat Dwyer

FOR several years Bill has indulged a hobby for collecting examples of artistic castings in various metals. He has quite a variety and probably derives more pride from their possession than many a millionaire does from a collection of stocks and bonds. Speaking from personal experience I am inclined to the opinion that his enjoyment is closely patterned on that of the small boy with his first collection of gorgeously colored glass alleys, taws or aggies.

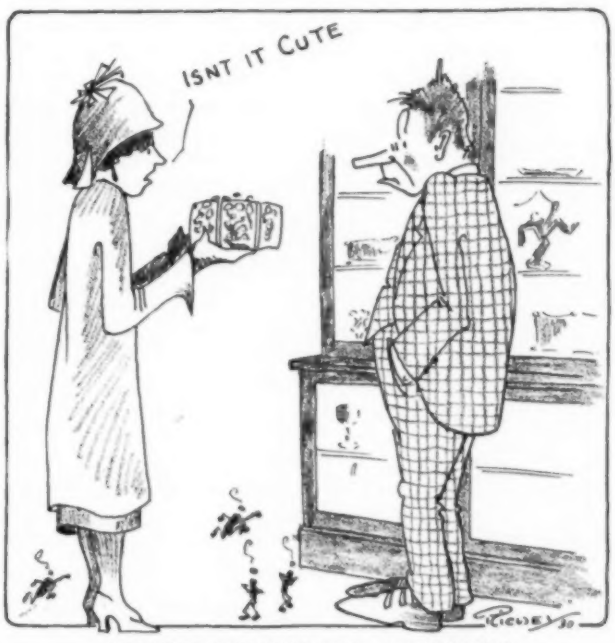
To the boy, each marble is an individual gem. He is familiar with every shade of coloring, with every curl and twist of the streaks in some of them and with the sweet, translucent gleam that lurks in the heart of the brilliant reds, blues, yellows, greens and purples.

He loves them all with a universal love, but usually there is one that is prized above the others. It may not be the most beautiful from an artistic viewpoint, but when it has helped him to emerge victorious from many a hard fought tournament, he is inclined to invest it with miraculous powers. It is his lucky aggie and he would yield up his right eye in preference to parting with it—willingly. This type of love—you might call it a mild form of idolatry—is illustrated by the late Chas. Dickens in the preface to one of the many editions of *David Copperfield*. "I have been asked," he wrote, "which of my books I liked the best. I have loved all my brain children with a parent's love, but as with every parent, one lies a little closer than the others to my heart. With me this one is *David Copperfield*." I do not know if Bill has any particular favorite. One of his chief delights is to show his treasures to those who can appreciate the artistic conception and the highly skilled craftsmanship involved in their production. "What's the use," he inquires bitterly, "in showing those things to a Yahoo who does not know whether they were cast, punched or gnawed out of a hunk of pig iron with a hammer and chisel. One who has no conception of the infinite care, high technical knowledge, skill of hand and eye developed over a long period, represented in each of these little gems. On one occasion I showed a box, covered with the most ornate and delicate carving, to a lady and all she said was: 'Oh, my, isn't it cute!'"

The other night Bill brought over for my inspection, his latest acquisition, a beautiful little figure of a lion sent him by his old friend Louis Hoster whose shop in Bessemer, Ala., long has been famous for turning out some of the largest and most intricate castings produced in the South.

Association of ideas reminded Bill of the time he worked in Birmingham while that city was all agog over the casting of a heroic figure of Vulcan for exhibition in the Alabama section of the Louisiana Purchase exposition at St. Louis in 1904. The figure was modeled by a famous New York sculptor. It was cast in sections and assembled in a Birmingham foundry that long since has joined the silent majority.

"Of course," Bill remarked, "I am not familiar with all the circumstances and there may have been other contributory factors, but one of the reasons it joined the silent majority, is the same reason that has forced many another good foundry off the map. The foundry offered to make the job for $7000 and this sum was raised by popular subscription. At the final cleanup it was found that the cost was over $9000. The statue excited a great deal of favorable comment at the exposition and reflected great credit on the iron industry of the sovereign state of Alabama. 'Twas a boon to Alabama, but believe me it was a pain in the neck to the foundrymen who made it. In the original plan the figure was designed to be mounted on a pedestal 45 feet in height and for that reason the head and neck were modeled on a larger scale than the remainder of the figure to bring the *tout ensemble* into proper perspective. Unfortunately the original plan never was carried out. After the exposition was over, Vulcan returned to Birmingham, but civic politics and clashing personal interests interfered with the adoption of a satisfactory site. It was shunted around from pillar to post. For one period of its existence it served to exploit an enterprising manufacturer's beverage. The spear was removed from Vulcan's



AND ISN'T THE HAT JUST A DARLING?

strong right hand and replaced by an over sized bottle of the more or less famous invigorator.

Finally, several years ago, the doughty blacksmith and his anvil were carted out to the Fair grounds and set up a short distance from the entrance on the inside. That in itself was quite a job. The figure stands 55 feet high from his sandaled feet to the top of his curly head. A long wood prop supports the left arm which appears to have been broken and reset none too skillfully.

Once a year, at fair time, crowds throng the place. They eat hot dogs, candy, peanuts and popcorn and probably wonder who is the old guy standing there in solitary and pathetic splendor. Once an object of pride to the community and the inspiration for columns of newspaper space, the figure now excites no more interest than the cast iron dog which at one time flourished so vigorously on the front lawn of the elite. Only its size and weight have preserved it thus far from the fate of the cast iron dogs which ultimately found their way back into the cupola with the pigs. Perhaps some day—or preferably, some dark, rainy night—Vulcan from his forge on High Olympus will drop a bolt of lightning on this, his earthly image and reduce it to heavy machine scrap $15 per ton f.o.b. Birmingham.

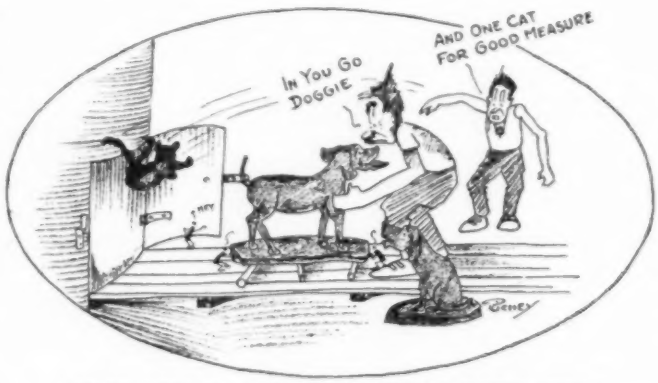
"On the other hand," Bill remarked speculatively, "wouldn't it be a curious thing if the figure toppled over and then was allowed to lie there until in the fullness of time it became covered over with dust and debris. Such things have happened in the past and I see no reason why they should not happen in the future.

"Just imagine the excitement about the year 2030 if a steam shovel, snorting and rooting in the bottom of a huge excavation, should uncover this gigantic iron man. Eminent savants would swoop in like a flock of vultures and hold extended post mortems. They would divide instantly into two camps. One holding firmly to the opinion that the figure was that of an antediluvian man, a member of the race which formerly inhabited this continent. They would prepare long papers copiously illustrated with charts, tables and footnotes to prove that the body, lying for unnumbered centuries in this iron ore region, gradually had become impregnated with iron and assumed its present status.

"Members of the second camp would laugh this silly theory to scorn. Highly scientific scorn, of course, but nevertheless just as biting as the common or garden variety, indulged in by two ordinary citizens discussing the rival merits of their favorite pugilist or racehorse.

"Iron ore is iron ore they would remark, scathingly, otherwise oxide of iron. A human body buried in iron ore would have as much chance of becoming an iron man, as a hunk of boloney buried in dogwood saw dust would have of becoming a Russian wolf hound with a leash and a brass studded collar, around his skinny neck.

"The dissenters would direct attention to the fact the figure was merely a hollow shell and ask triumphantly what that meant. Answering their own question—as usual—they would say it meant just one thing. The figure was a suit of armor worn by one of the early inhabitants as a protection from the dinosaurs and other mighty beasts, with unpronouncable names almost as long as themselves, who roamed over the earth in those days.



FIRST STEP IN THE PREPARATION OF HOT DOGS

"No great stretch of the imagination is required to visualize one of the second class boys nonchalantly swinging his highly polished glasses on the end of a broad black ribbon and remarking to one of the boys of the first class: 'Ha, ha, my dear fellow. How about laughing that one off!' "

"Your theory is ingenious," I admitted, "but I think it reflects more credit on your imagination than it does on your common sense—if any. My own private opinion is that eventually Octavus Roy Cohen will bid Vulcan in at a sheriff's sale, paint it a deep black, rechristen it *The Toreador* and set it up at the corner of Eighteenth street and Third avenue as a permanent memorial to Florian Slappey, the champion bull thrower of the South and intervening way station."

"Not so good," Bill said. "Not so good. In less than a week after Florian learned he had an interest in the thing, he either would pawn it or get mixed up in a law suit trying to sell it to the Sons and Daughters of I Will Arise!

"However, attempting to peer into the future, simply is waste of time. No person can foretell the life history or ultimate fate of a casting. Some castings have the lives of a cat.

"A large bronze bell has been doing regular duty for the past 90 years in the belfry of a church in Ellicottville, N. Y. Certainly if any person had told Senor Bargas when he cast that bell in his foundry in Malaga, Spain, in 1708 that 220 years later the same bell would be hanging in an American church belfry and summoning members of an alien faith to worship, his pointed moustachios would have been elevated in eloquent disbelief. This bell weighing about 1300 pounds is a beautiful example of the bell founder's art. A raised cross inside an ornamental triangular frame appears on one side. A nail above the end of each arm points downward at an angle and another on the right side near the bottom points toward the foot. Two lines of antique characters form a frieze around the bell near the top. The archaic Spanish inscription reads: *Abe Soi Labos Del Angel Ov Een Alto Svena Maria Garcia Plena, Bargas Mefeci, Malaga,* 1708.

"In modern Spanish this would appear as: *Ave Soi la voz angel que en alto svena Maria, plena gracia,* and may be translated: Hail, I am the voice of the angel who on high sounds forth, Mary, full of grace. Bargas made me in Malaga in 1708.

"This bell originally was one of a set of chimes in an old Spanish monastery. In the turbulent days of Charles V, grandson of Louis XIV, the monastery was sacked and burned. The bells disappeared until early in the nineteenth century they found their way to America as ballast in the hold of a Spanish vessel. The fate of the other bells is unknown.

"The lone survivor was brought to New York and shipped to Albany, thence to Buffalo on the old Erie canal and then hauled by ox team a distance of 50 miles to its present destination.

"Some of these old boys," Bill continued, "were master foundrymen considering the handicaps under

which they were forced to operate. Even at the present day, under certain conditions, foundrymen are confronted with peculiar problems.

"Some times I get an inquiry from some out of the way place regarding a tricky point in foundry practice. Without a knowledge of the equipment and facilities available in that particular section I am handicapped in my desire to furnish what the inquirer probably expects—a short and snappy answer.

"You know the old saying about more ways than one to choke a cat, or skin it or something like that—well the saying also is applicable to the foundry. There are more ways than one to make almost any job and the best one only can be determined by a knowledge of all the existing conditions. For example, advice to a man to make a casting in a dry sand mold would have little application if he had no iron or steel flask, no oven, or no knowledge of dry sand molding practice. An acetylene torch is a fine tool for cutting risers, but a man who has no acetylene torch may have to use a drill press to bore a row of holes through the neck of the riser and then knock it off with a drop ball. The acetylene torch or the electric arc are employed extensively for mending defective castings, but if neither one is available the job in many instances may be accomplished by the foundry process known as *burning on*. A stream of exceedingly hot metal is poured over the defective area until the surface is fused.

"Some defects lend themselves readily to this process, while in others the attempt is practically impossible. The size, shape, thickness and composition of the casting must be taken into consideration. In some instances the weld may be effected without preheating the castings, but in the majority of instances the entire casting must be heated to a red heat and that feature presents practical difficulties.

"I had an inquiry the other day from a man who wanted to know if there is any way in which he could repair a crack in a 400-pound cast iron bell with a metal thickness of about 3 inches. The crack was 4 inches long, presumably extending that distance inward from the mouth of the bell. He also asked for a suitable mixture for a bell of that size.

"A bell is a peculiar casting in more ways than one. In service it is subjected to heavy and intermittent vibration from the clapper. Unless it is correctly designed, molded, poured and cooled, internal strains are set up and sooner or later the vibration causes it to crack. The crack relieves the strain, but if it is mended, the diameter is larger than it was before and the tone of the bell is changed to a greater or less extent. Also if the bell is not raised to a red heat, the welding process will set up additional strains and it will crack again when placed in service.

"The best and safest solution of the present problem is to cast a new bell. If necessary the old bell may

HE ISN'T QUITE SURE WHO OR WHAT HE IS

be used for a pattern to be molded with the mouth down. As a precautionary measure the inside may be formed with a dry sand core fastened with a hook through the bottom board. The bell will serve for a corebox and the core may be placed in the oven before the mold is made.

"As an alternative method, a print may be attached to the mouth of the bell and the core may be struck up with a sweep on the plate. Do not attempt to form the core from two pasted halves. The completed core will not be truly round and the thickness of the casting will not be uniform. Leave the casting in the mold over night.

"The iron mixture is not particularly important. A hard iron will yield a stronger and more resonant tone than a soft iron, but as the hardness increases, the tendency to crack becomes more pronounced. In this particular instance a satisfactory mixture may be made up of equal parts machinery scrap, stove plate scrap and agricultural scrap to yield an anticipated analysis of silicon 1.30 per cent, sulphur 0.10 per cent, manganese 0.40 per cent and phosphorus 0.60 per cent.

"If an attempt is made to weld the crack the entire casting *must* be raised to bright red heat. The most convenient way to do this is to lay the bell on its side with the cracked section on the bottom and level. A steel shield is erected at the mouth with a hole in the center for the nozzle of an oil or gas torch. The oil flame will raise the casting to a red heat. Then the shield is raised to permit the welder to work on the crack. Other suitable covering is placed over the bell to prevent the heat from affecting the workman. If gas or oil are not available, the bell may be heated in a wood, coke or charcoal fire inside a temporary brick furnace, but this at best is an awkward makeshift and difficulty will be experienced in obtaining a uniform heat all through the casting. With either the acetylene or electric arc, it will be necessary first to enlarge the crack to a V-shape before proceeding with the work of welding. This precaution also is advisable, though not strictly necessary where the burning-on method is practiced. The molten metal will melt its own way through. In fact the adjoining metal on both sides of the crack must be melted back for a distance of ¾ or 1 inch to insure a satisfactory union. A dry sand core conforming to the outside contour of the bell is placed under the crack. A second dry sand core about 2 inches thick and with a rectangular opening approximately 2 x 8 inches is placed over the crack on the inside of the bell. The stream of metal is played back and forth over the crack until the operator, with a bent rod, is satisfied that the entire area under the 2 x 8-inch opening in the core is molten down as far as the lower core. A channel in the outer end of the upper core allows the metal to flow away into a suitable pig bed. The depth of this channel may be regulated so that at the conclusion of the operation the metal in the weld does not extend more than about ¾-inch above the inside surface of the bell. The entire casting then is buried quickly in dry sand and allowed to remain until it becomes cold. On the following day the excrescence may be chipped or ground down to conform with the inside contour of the bell.

"However, as previously stated the safest method is to cast a new bell. The welding method is hazardous.

DAN M. AVEY
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The Shakeout

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¶Tell Them What They Want

HOW often under the old regime did the foundryman venture to suggest to a customer a better way to make a casting, or a combination of a casting with some other part to effect certain mechanical operations? Rather, was it not the usual practice to accept what was offered, even grudgingly in some cases, and make the best of it? True, a pattern might be questioned, or an argument might arise as to a proposed casting, but usually it was on the basis of the foundryman's interest. He would kick on a pattern which would be difficult to reproduce, or would insist upon changes in gating to accord with his own ideas, but the customer's viewpoint seldom was considered by the foundrymen. Those conditions have changed.

MODERN foundries that are going after business, and getting it, have adopted new tactics. They are studying the customer's requirements. They are looking into the shops of present and possible buyers of castings to study where they can develop business. This is the modern trend. It means going out for business, and developing it where it never before has existed. A notable instance is furnished by a steel foundry making castings for a road machinery firm. A new design of an under frame, made of both cast and welded members has displaced an all welded structure with a resultant saving in cost and gain in strength. The modern foundryman tells the customer what he should buy by aiding himselve his problems.

¶Increase Shows New Trend

WHILE no figures are available on the tonnage of gray iron castings produced in 1929, an increase over the total output of 1928 is indicated in the statistics on pig iron production recently released by the American Iron and Steel institute. During 1928 a total of 3,808,988 tons of foundry pig iron was produced for sale while in 1929 the amount was 4,112,649 tons. This is an increase of 303,661 tons or 7.97 per cent. Production of malleable pig iron for sale showed a remarkable increase over the same period. The figures as given are 1,700,178 tons for 1928 and 2,060,662 tons for 1929. The increase is 360,484 tons or 21.20 per cent. This increase cannot be attributed wholly to an increase in malleable castings production as a reliable estimate places production in 1929 at 5 per cent over the output in 1928. However, it is known that many gray iron foundries are using more and more malleable pig iron to improve their mixtures. Hence, a large part of the gain in malleable pig iron production may be attributed to gray iron foundry demand for that material.

¶Meet the Professors Half Way

WHEN Professor Beese of Pennsylvania State college offered some pertinent questions relative to the foundry industry and what it needs in the way of educated employes, he performed a real service to the industry. The response from those high in the councils of operating foundries and identified with the dissemination of technical information was prompt and positive. Much of this was summarized in THE FOUNDRY for March 15. Further comment now is accumulating from the colleges and universities that stand ready to provide the engineer with what he needs in foundry education. Some of these comments appear on other pages of this current issue and many others, interesting and earnest, will appear in succeeding issues.

NO RELUCTANCE is apparent in the attitude of the educators. They are willing and anxious to provide those courses of instruction that will give college men what they need for foundry executive positions, or that will offer engineering students the fundamental knowledge they should have of foundry methods and products. The question is fast reducing itself. What should colleges provide in their courses of study to meet the requirements of the industry for trained men and to give engineers an understanding and appreciation of cast metals?

THE foundry industry should be heard. The pages of THE FOUNDRY are open for the expression of opinion either from the colleges or the active thinking men of the foundry industry. The American Foundrymen's association, always a strong factor in the educational leadership of the foundry world, may find this a worthy subject for study and investigation. The need is evident.

Comings and Goings of Foundrymen

Men of the Industry, Whose Activities Are Making Foundry History

J. G. PEARCE, director and secretary of the British Cast Iron Research association, will present the annual exchange paper of the Institute of British Foundrymen before the Cleveland meeting of the American Foundrymen's association, May 12-16. His paper will be on "Correlation of Tests for Cast Iron." Educated at the University of Birmingham, where he studied mechanical and electrical engineering, he received the degree of bachelor of science and subsequently the degree of master of science. Following his graduation, he spent two years in the works and offices of the British Westinghouse Electric & Mfg. Co. Ltd., Trafford Park, Manchester. The firm, with which Mr. Pearce was associated for some years, later became the Metropolitan-Vickers Electrical Co. Ltd. At the end of his apprenticeship, following a period spent in engineering design, Mr. Pearce assisted A. P. M. Fleming in establishing a new department, subsequently called the research and education department, which in a few years became a model of its kind. The experience gained was embodied in two books written jointly with Mr. Fleming: "The Principles of Apprentice Training" and "Research in Industry." In 1923 Mr. Pearce spent about seven months in the United States and Canada as liaison engineer to Metropolitan-Vickers Ltd. Since 1924 Mr. Pearce has been director and secretary of the British Cast Iron Research association. This is an organized technical body for promoting research and development in the ferrous founding industry. Mr. Pearce is a member of the Institution of Electrical Engineers, Institute of Mechanical Engineers, the Iron and Steel institute, and the Institute of British Foundrymen. In 1928, he was awarded the first prize in an open competition in Great Britain. judged by representative leaders of capital, labor and management, for an essay, since published, on the most practicable methods for promoting goodwill in industry.

James F. Stack has been appointed foundry manager of the Enterprise Foundry Co., Kansas City, Mo., succeeding the late Charles M. Cravens.

J. D. Oliver and James Oliver II, both of South Bend, Ind., were reelected directors of the Oliver Farm Equipment Co. at the recent annual meeting.

John E. Galvin, president of Ohio Steel Foundry Co., Lima, O., has been elected president of the Lima Manufacturers' association to succeed Benjamin F. Thomas.

L. C. Conradi has been appointed metallurgist for the Lycoming Mfg.

J. G. PEARCE

Co., Williamsport, Pa. Previously he had been chief chemist of the Plainfield Mfg. Co., a division of the Spicer Mfg. Corp., South Plainfield, N. J.

W. J. Bunn, for 14 years connected with the Republic Motor Truck Co. Inc., Alma, Mich., has been appointed general manager of the Advance Casting Co., St. Louis, Mich., formerly operating as the Spanstra Mfg. Co. The company manufactures gray iron castings and is headed by John Spanstra.

C. W. Beese, professor and head of the department of industrial engineering at Pennsylvania State college, State College, Pa., has resigned to take an industrial engineering position in connection with the floor division of the Armstrong Cork Co., Lancaster, Pa. Mr. Beese has been connected with Pennsylvania State College since 1922 first as instructor and later as professor and department head.

G. H. Jewell, formerly assistant to the late W. D. Hess, western sales representative of Glamorgan Pipe & Foundry Co., Lynchburg, Va., has been appointed western sales manager of the company with headquarters in the Peoples Gas building, Chicago.

Justin McCarthy has been placed in charge of cost accounting for Schill Bros. Co., Crestline, O.. and Clem A. Schill is in charge of purchasing.

Dr. Richard Seligman, recently elected president of the British Institute of Metals, was born in London in 1878. He was educated at Harrow and at the Central Technical College City and Guilds institute. In 1898 he was awarded an associateship and later studied chemistry at the University of Heidelberg, Germany. He transferred to Zurich in 1900 and engaged in research work. Later he returned to Heidelberg and gained his doctor's degree in 1902. He worked for the Niagara Research Laboratories, Niagara Falls, N. Y., for a time and then became chief chemist for the United States Zinc Co., Pueblo, Colo. In 1905 he was appointed chief chemist for the British Aluminum Co. He resigned that position to form the Aluminum Plant & Vessel Co., Ltd., Wandsworth, London in 1909. He still is connected with that company.

Clyde E. Williams, formerly chief metallurgist, Columbia Steel Corp., San Francisco, has been appointed assistant director of the Battelle Memorial institute, Columbus, O. Mr. Williams is a graduate of the University of Utah. After graduation, he became connected with the lead and copper smelting industry for 2 years. He then accepted a position with the bureau of mines to assist in work on alloy steels and ferroalloys. Following the war he served with the Hooker Electrochemical Co., New York, for a short period and returned to the bureau of mines as superintendent of the northwest station at Seattle. In 1924 he accompanied Dr. H. Foster Bain to Argentina to report to the government of that country on the development of its iron, steel and coal industries.

Robert Hoierman, formerly field executive of the Memorial Craftsmen of Ohio, was appointed executive secretary of the Ohio Foundries Asso-

ciation Inc. at a meeting of the board of directors held March 26. Mr. Hoierman was born in Bloomington, Ill., in 1890 and was graduated from the University of Illinois, Urbana, Ill., in 1912 with a bachelor of science degree in mechanical engineering. He then served as paymaster in the navy for several years. Following the war he was made assistant secretary of the chamber of commerce at Massillon, O., specializing in welfare work. Later he was connected with the chamber of commerce at Alliance, O. In 1924 he organized the Associated Trades of Commerce at Alliance. This organization is a consolidation of the retail interests of the city. In connection with the work at Alliance, he has been doing special trade association work and has been field executive of the Memorial Craftsmen of Ohio.

D. J. Campbell, head of Campbell-Wyant-Cannon Foundry Co., Muskegon, Mich.; Adam Pyle, head of Pyle Pattern Works, Muskegon, and Mathias Young, president of Lake Shore Machine Co., also of Muskegon, have been added to the board of directors of St. Joseph Electrical Steel Castings Co., St. Joseph, Mich. Other members of the directorate are J. J. Theisen, re-elected president of the company; James P. McKeon, vice president, general manager and treasurer; R. W. Moon, of St. Joseph, Mich., and L. E. Noel, of Grand Rapids, Mich. Lester Neuman was named secretary.

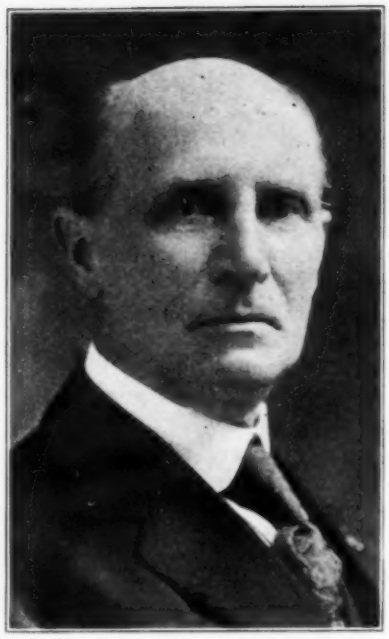
Book Review

Market Data Handbook of the United States, by Paul W. Stewart, domestic commerce division, United States department of commerce, cloth, 534 pages, 9 x 11½ inches, published by the United States government printing office and supplied by the superintendent of documents, Washington, for $2.50.

This book, which has been made available for those interested in marketing in the United States, has been published to satisfy the demand for statistical information upon which to base economical marketing or sales operations. The data included in the handbook have been gleaned not only from government sources but also from private businesses.

While the primary object of the compilation of this vast amount of data is to furnish a convenient source of market statistics, it also may serve as a guide in the evaluation of the major basic activities in all sections of the country and may form the basis of comparison in a wide variety of fields.

Three general types of markets are considered, the general consumer, the farm and the industrial. The country has been divided into counties as the basis of comparison. In each of the classifications those items have been grouped which were thought to be of greatest value to those interested in marketing problems.



R. H. PALMER

The first portion of the book is devoted to the introduction which outlines the methods used in compiling the data included and explains terms used. It also contains an explanation of the tables and where the data in them was obtained as well as a short resume of some of the figures quoted. The second part of the volume is the bibliography. The remainder of the book is devoted to tables of statistics on various markets.

This book should be of particular interest to those interested in market measurements which should include chiefly those concerned with distribution of commodities, etc.

Depart for Russia

Fifteen officials and technical experts of the Austin Co., Cleveland, who were leaving for Russia to begin the construction of the industrial city at Nizhni Novogorod, were the guests at a farewell party given by members of the company at the Cleveland club, March 26. The party will be led by G. A. Bryant, Jr., vice president of the company and will include H. F. Miter, vice president in charge of foreign operations; T. B. Jorgensen, project engineer; H. D. Kempler, general auditor of the Russian project; R. C. Farrington, general mechanical engineer; C. F. Appleton, H. C. Patterson, Ray C. Vore, A. J. Marsh, P. K. Davis, F. Karel Van Havermaet, and Allan S. Austin, engineers for the project.

Obituary

R. H. Palmer, for more than 50 years connected with the foundry industry as molder, foreman superintendent and manager of foundries, and formerly instructor in foundry practice at Worcester Polytechnic institute, Worcester, Mass., died April 1. Mr. Palmer entered the foundry industry when he became an apprentice molder at the plant of the Rhode Island Locomotive Works, Providence, R. I., on March 4, 1872. He continued to work as a molder until 1883, when he was appointed foundry foreman. During the intervening years he served as foreman and foundry superintendent in a number of foundries in seven states and Canada. In 1916 he was appointed foundry manager of the Automatic Machine Co., Bridgeport, Conn. He also served as instructor in foundry practice at the Worcester Polytechnic institute, Worcester, Mass., and it was during that time he wrote a book entitled "Foundry Practice," to be used as a text book for instruction in that subject. He contributed many articles on foundry practice that have been published in THE FOUNDRY and other publications.

Charles A. Anderson, 68 years old, formerly chairman of the board of the Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, died April 5.

Augustus H. Bullard, secretary and treasurer of the Bullard Co., Bridgeport, Conn., machine tool manufacturer, died April 5 at a hospital in that city. He was 63 years old. Mr. Bullard served for two years as president of the Connecticut Manufacturers' association.

Nathan B. Marple, 72 years old, director and Columbus, O., manager for the American Chain Co., Pittsburgh, died recently at Columbus. He had been successively connected with the Peter Hayden Co. which was sold to the Standard Chain Co., which, in turn, was absorbed by the American Chain Co.

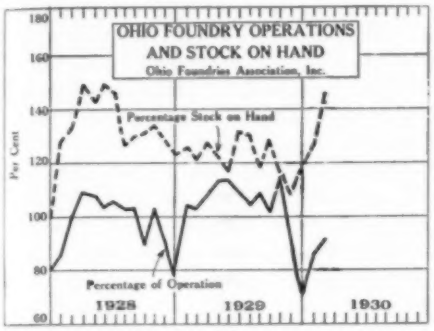
Robert J. Davidson, treasurer of the Ramapo Ajax Corp., Hillburn, N. J., with which he had been associated 47 years, died April 3 at his winter home in Daytona Beach, Fla. He was 79 years old. Mr. Davidson became secretary of the Ramapo Iron Works in 1883 and helped organize the Ramapo Foundry Co., which later merged with the American Brake Shoe & Foundry Co., of which he was a director for many years. He was a director of the Manganese Steel Co., the Bronze Metal Co. and vice president of the G. W. Garnrick Co.

Trade Trends in Tabloid

OPERATIONS of steel foundries are increasing slightly and prospects for business in the near future are fair to good, according to reports recently made by members of the Steel Founders Society of America. While several plants are working at better than one hundred per cent of capacity, the average operations of all members reporting is 78 per cent. Practically all reports show inquiries steady or on the increase.

—T—T—

Orders received by Foote Brothers Gear & Machine Co., Chicago, for the



first quarter of 1930 exceeded those for the same period in 1929 by 30 per cent.

—T—T—

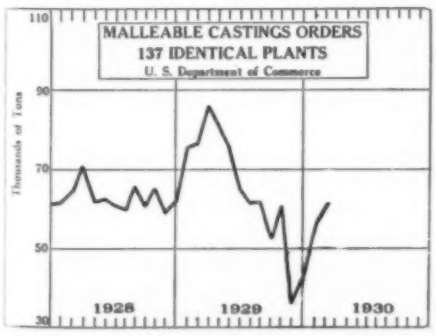
Production of malleable castings in February, as reported to the department of commerce by 120 firms operating 133 plants, was 67.4 per cent of capacity compared with 61.2 per cent in January and 77.1 per cent in February, 1929. Orders for the first two months of the year totaled 118,524 tons.

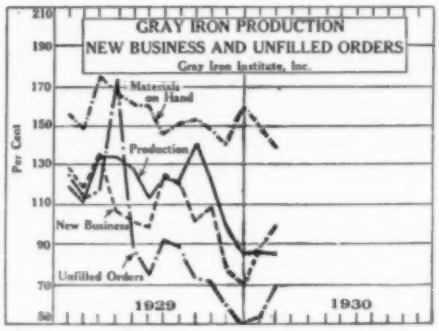
—T—T—

Patternshops in various sections report substantial increases in inquiries and orders, which should be reflected in increased castings orders in the near future.

—T—T—

Slowness of automotive releases and business from parts makers and allied industries has necessitated aluminum





jobbing foundries in the Chicago territory working on a part time basis. However, a number of foundries doing special work are fairly well occupied. A substantial pickup has been noted in the operation of brass shops.

—T—T—

Automobile production in March increased 18 per cent as compared with the previous month, according to an estimate of the National Automobile chamber of commerce. Approximately four hundred thousand cars were produced during the month.

—T—T—

A decided pickup was shown in orders for enameled sanitary ware in February. Orders for bath tubs totaled 64,732 units in February compared with 32,558 in January. Orders

RAW MATERIAL PRICES

April 8, 1930

Iron	
No. 2 foundry, Valley	$18.50
No. 2 Southern, Birmingham	14.00
No. 2 foundry, Chicago	19.50
No. 2 foundry, Philadelphia	20.26 to 20.76
No. 2 foundry, Buffalo	18.50
Basic, valley	18.50
Basic, Buffalo	18.00
Malleable, Chicago	19.50
Malleable, Buffalo	19.00
Coke	
Connellsville beehive coke	$3.50 to 4.85
Wise county beehive coke	4.25 to 5.00
Detroit by-product coke	9.00
Scrap	
Heavy melting steel, Valley	$16.00 to 16.50
Heavy melting steel, Pitts	16.00 to 16.25
Heavy melting steel, Chicago	13.00 to 13.50
Stove plate, Buffalo	11.75 to 12.00
Stove plate, Chicago	10.00 to 10.50
No. 1 cast, New York	10.85
No. 1 cast, Chicago	14.00 to 14.50
No. 1 cast, Philadelphia	15.50
No. 1 cast, Pittsburgh	14.50 to 15.50
No. 1 cast, Birmingham	10.00 to 11.00
Car wheels, iron, Pittsburgh	14.50 to 15.00
Car wheels, iron, Chicago	14.50 to 15.00
Railroad malleable, Chicago	16.50 to 17.00
Agricultural mal., Chicago	14.75 to 15.25
Malleable, Buffalo	17.00 to 17.50
Nonferrous Metals	**Cents per pound**
Casting, copper, refinery	17.25 to 17.37½
Electro, copper, producers	18.00
Straits, tin	36.37½
Lead, New York	5.50
Antimony, New York	8.00
Nickel, electro	35.00
Aluminum, No. 12, producers	23.00
Aluminum, No. 12, remelt	16.00 to 16.50
Zinc, East St. Louis, Ill.	4.95 to 5.00

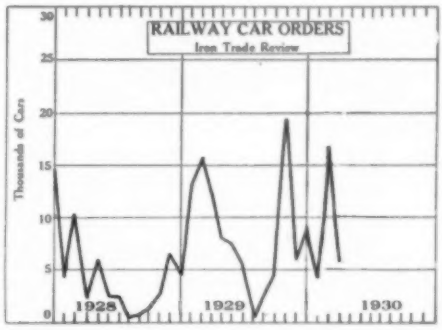
for sinks were 91,348 units in February and 49,776 in the previous month.

—T—T—

New business in gray iron shops, as reported by the Gray Iron Institute, jumped from 89.4 per cent in January to 98.2 per cent in February. Production during the latter month, as related to normal production, was 85.5 per cent. January was on the basis of 88.5 per cent.

—T—T—

Buying of pig iron has increased in the Birmingham district during the past two weeks. While numerous sales have been made to cast iron pipe



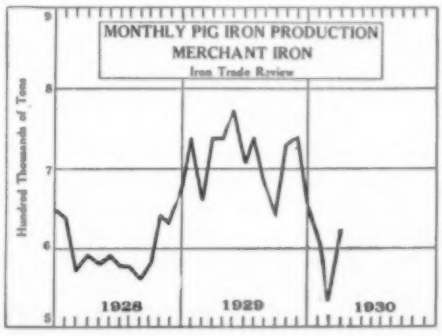
makers, other foundry interests have been buying substantially. Shipments of iron in the Cleveland territory are advancing with the movement to automobile shops increasing.

—T—T—

Daily production of pig iron in March gained 3.9 per cent, according to *Iron Trade Review*. Total output was given as 3,271,122 tons, while the daily average rate was 105,520 tons, compared with 101,640 tons in February. Merchant iron production in March registered 740,966 tons.

—T—T—

Average New York prices of nonferrous metals during March, according to *Daily Metal Trade*, follow: Casting copper, 17.30c; electrolytic copper, 18.00c; Straits tin, 36.802c; lead, 5.667c; antimony, 8.30c; aluminum, 23.90c. Zinc averaged 4.946c, East St. Louis, Ill.

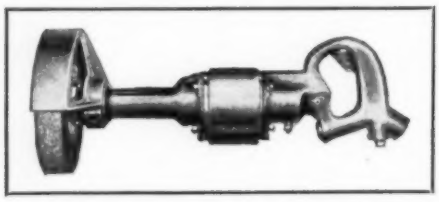


Introduces Air-Driven, Portable Grinder

Chicago Pneumatic Tool Co., 6 East Forty-fourth street, New York, has introduced the first of its line of air tools to be built on the rotary principle. This tool is a portable grinder.

The operation of the machine depends upon the rotation of four vanes mounted on a spindle which rotates within a casing having suitable openings for the admission and escape of compressed air. The efficiency of this tool depends upon the even distribution of air upon the vanes rather than upon air pressure.

The new grinder is governor controlled and has little vibration. It



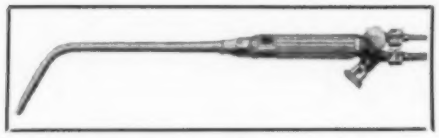
OPERATION DEPENDS ON THE ROTATION OF FOUR AIR VANES

is equipped with a removable air strainer, heavy duty radial and thrust ball bearings on the wheel end and renewable, hardened rotor liner. The rotor is mounted on over-capacity ball bearings. Lubrication is secured by an automatic oiler in the rotor housing and grease plugs in the handle and gear case ends.

The tool is designed for 8 x 1-inch rubber or elastic bonded or 6 x 1-inch vitrified wheels. It is furnished with either a straight or pistol grip handle and with 6-inch or 8-inch wheel guard. The machine weighs 16 pounds.

Welding Blowpipe Is a Compact Unit

Oxweld Acetylene Co., 30 East Forty-second street, New York, is placing on the market a new blowpipe, employing the same low-pressure injector principles of other blowpipes made by the company. The unit is a full-sized design blowpipe, large enough for any welding job. The tip and welding head are of one-piece construction, being combined in a long slender stem of the goose-neck type, as shown in the accompanying illustration. The injector is located at the base or handle end of the stem. Each welding head has its own nut for attaching it to the handle of the blowpipe. This nut has been constructed so that it extends beyond the injector when the welding head is detached



THE TIP AND WELDING HEAD ARE OF THE GOOSE-NECK TYPE

from the blowpipe and serves to protect the injector from damage by careless handling. A fine pitch thread makes possible the tightening or loosening of the nut without the aid of a wrench. The handle of the blowpipe is made of brass tubing with longitudinal ribs. Valve wheels are newly designed and are readily accessible yet out of the way during welding operations. The blowpipe is light and compact. With a No. 4 welding head, it weighs 24 ounces.

Hold Safety Convention

The fourth annual Southern States Safety conference was held March 27, at Birmingham, Ala., under the auspices of the Birmingham Safety council. The entire morning was devoted to the discussion of industrial safety topics. Among the speakers were Chester E. Johnson, National Underwriters association, who spoke on fire prevention; John H. Taylor, Birmingham commissioner of public safety, who spoke on "The Relation of Public and Home Accidents to Industry and Business," and C. E. Pettibone, president, National Safety council, who had for his subject, "Safety, a National Problem."

Movable parts operate on ball or roller bearings. The device is capable of handling ladles up to 1000 pounds capacity

New Circuit Breakers Are Trip Free

A new line of air circuit breakers has been placed on the market by the General Electric Co., Schenectady, N. Y. The principal advantages claimed for these breakers are: trip-free from the handle on overcurrent; triple contact; no burning on the main brush; the burning tips easily replaced; high pressure main contact formed of laminations which make end-on contact with heavy and uniform pressure; is closed easily with a wiping motion; and low operating temperature. The breakers are available for either instantaneous or time delay automatic operation in either single-, double-, or triple-pole combinations with the necessary accessories.

Three classifications of breakers for voltages of 650 volts and below are available. One type is a compact breaker applicable to industrial service and in buildings where the current is from 3 to 300 amperes. Another type is for moderate duty service rated 1200 amperes and below. The third is for moderate or heavy duty service ranging from 1600 amperes up.

Pouring Device Handles 1000-Pound Ladles

Modern Pouring Device Co., Port Washington, Wis., has designed a new pouring device for handling ladles up to 1000 pounds capacity. The raising apparatus of the new mechanism consists of a planetary gear system operating on the ladle supporting rack. The large operating handwheel, shown in the accompanying illustration, enables quick raising and lowering, but under precise control, so that the ladle can be spotted quickly at any desired height. The unit is of all-steel construction and all movable parts operate on roller and ball bearings. The rack rollers are bushed with self-lubricating bearing metal. Equipment includes a geared ladle with totally enclosed worm wheel operating in a continuous bath of oil. The worm operates on tapered roller bearings and has an adjustment to take up the lost motion between it and the gear after some usage. The machine also may be used for handling various loads in the foundry in place of a chain block. For work of this nature the

raising rack is equipped with either a bail or a single hook at the lower end.

Will Speak to Various Local Associations

J. G. Pearce, director, British Cast Iron Research association, Birmingham, England, and author of the exchange paper of the Institute of British Foundrymen which will be presented at the coming Cleveland convention of the American Foundrymen's association, will embark on a speaking tour soon after his arrival in the United States on April 28. During the tour he will address the New England Foundrymen's association April 29; Chicago Foundrymen's club on May 1; the Detroit Foundrymen's association on May 2; Quad-City Foundrymen's association on May 5; Chicago Foundrymens' club on May 6; Wisconsin Gray Iron Foundry group on May 7; and the St. Louis District Foundrymen's club on May 8. He then will go to Cleveland to attend the foundrymen's convention and immediately following the meeting will leave for Canada, where he will spend a week. Following his Canadian trip, he will address the Philadelphia Foundrymen's association on May 27. He will sail from New York on May 30.

Addresses London Branch of Institute

Dr. Siegfried G. Werner, president, Verein Deutscher Eisengiessereien, the German association of foundry owners, presented a paper at the meeting of the London branch of the Institute of British Foundrymen on March 20. The paper dealt with the organization of the foundry industry in Germany, and with the progress which has been made in foundry technique, determination of costs and commercial organization. Dr. Werner for twenty years has been president of an association which counts among its members practically all foundry owners of Germany. It is a union both of the foundries and of the various sectional foundrymen's associations.

The aim of those associations, which have been working under the general supervision of the foundry owners' association, is to organize the industry of the country that the best results may be obtained without duplication of investigations, and with limited financial assistance. The association also works in close connection with the associatioin of German engineers.

Dr. Werner gave a brief review of the technical progress that has been made in Germany during recent years in the study of cast iron. He pointed out the modifications which have been made in the design of cupolas, and particularly mentioned the improvements that have been made in obtaining high-duty cast iron. The research work which has been responsible mainly for the production of high-grade cast iron in Germany was made possible by the activities of the association.

The activities of the association are not limited to actual technical subjects. A complete investigation of cost methods was made, and a series of charts were drawn up, giving foundry owners a method for determining the approximate cost of a given casting. Those charts have been distributed widely in Germany. An interesting point, partly a consequence of this important work, is that the association has been able to arrive at a practical standardization of selling prices over the country.

Speaks on Sand Mining

The regular April meeting of the Philadelphia Foundrymen's association was held April 9, at the Manufacturers club, Philadelphia. William J. Shennan, technical consultant and director, Paxson-Taggert, Inc., Philadelphia, was the speaker of the evening. His subject was "The Digging and Preparation of Molding Sand from Southern New Jersey." The talk was illustrated with motion pictures. Mr. Shennan formerly was connected with the Bethlehem Steel Co. for 42 years. During the latter part of his service he was general superintendent of foundries which included iron, brass and steel. He also had charge of roll and ingot mold manufacture in the foundries. At present, he supervises the production of molding sand for the Paxson-Taggert Co.

Quad-City Group Meets

The regular monthly meeting of the Quad-City Foundrymen's association was held April 14, at the Fort Armstrong hotel, Rock Island, Ill. The meeting was addressed by Howard Rowe, Aluminum Co. of America, who spoke on "Foundry Methods."

F. E. Harrell has been appointed engineer in charge of drafting and experimental departments, Reliance Electric & Engineering Co., Cleveland, manufacturers of alternating and direct current motors. Mr. Harrell has been associated with the Reliance organization since his graduation from Purdue university in 1924.

Hercules Elects Officers

Hercules Powder Co., Wilmington, Del., recently elected the following officers at a meeting of the board of directors: R. H. Dunham, president; J. T. Skelly, vice president; T. W. Bacchus, vice president; N. P. Rood, vice president; C. D. Prickett, vice president; G. G. Rheuby, vice president; C. A. Higgins, vice president; C. C. Hoopes, treasurer and E. B. Morrow, secretary.

Hoist Makers Elect

The Electric Hoist Manufacturers association met at the William Penn hotel, Pittsburgh, March 20 and elected the following officers: Chairman, Joseph G. Worker, American Engineering Co., Philadelphia and vice chairman, D. S. Brisbin, Chisholm-Moore Hoist Corp., Tonawanda, N. Y. It was reported that electric hoisting had been adopted as standard practice in several industries that previously have not been extensive users. Hoist sales for 1929 were larger than any previous year.

Receives Promotion

Lloyd H. Weber, formerly connected with the advertising department of the *Cleveland Press*, Cleveland, and the *Canton Daily News*, Canton, O., has been appointed advertising manager of the Osborn Mfg. Co., Cleveland. Philip F. Smith, formerly advertising manager, has been appointed factory manager of the brush division of the company. The Osborn company specializes in the manufacture of molding machines, sand treating apparatus, sand and mold handling equipment for foundries and industrial and household brushes.

Establishes New Offices

Chicago Pneumatic Tool Co., 6 East Forty-fourth street New York, has opened branch offices at Perrine building, Oklahoma City, Okla.; 327 Philcade building, Tulsa, Okla. and Merchants & Manufacturers building, Houston, Tex. Service stations and warehouses have been established at Houston and Oklahoma City.

Frank Valtaire, formerly in charge of the foundry research division of the General Motors Corp., and a member of the works operating committee of that organization, has joined Egan, Webster & Co., Pittsburgh, as refractory engineer with headquarters in the General Motors building, Detroit. Mr. Valtaire has been active in committee work of the American Foundrymen's association.

What the Foundries Are Doing

Reflecting the Activities of the Gray Iron, Malleable, Steel and Brass Shops

Vulcan Engineering Works Ltd., Vancouver, B. C., has bought the Wallace Foundry Co. Ltd., on Granville island.

Kingsport Foundry & Mfg. Co., Kingsport, Tenn., has erected an addition, 75 x 84 feet, which increased the capacity 75 per cent.

Johnson Foundry Corp., 1119 North Main street, Los Angeles, has added a brass foundry to its facilities.

American Foundry, 906 Date street, Los Angeles, has added molding machine equipment to its foundry.

Carthage Foundry & Machine Co., Carthage, Mo., has been incorporated with $30,000 capital by Nellie B. Moore and Mildred Moore Jansen.

Ohio Steel Foundry Co., Springfield, O., recently opened its newly constructed unit for the production of alloy steel castings.

Rig & Reel Foundry & Machine Shop, Pomeroy, O., may be reopened. It is reported that car wheels will be manufactured there.

The foundry of the Automatic Machine Co., Bridgeport, Conn., has been leased to the General Foundry & Machine Co., Bridgeport, Conn.

Kenton Foundry Co., Scito street, Kenton, O., expects to begin operations April 1. Charles Meskey, Marion, O., will be in charge.

The American Machine & Foundry Co., New York, has acquired the Martin Miller Co., importer of baking machinery, with headquarters at New York.

Chamber of Commerce, Bucyrus, O., is said to be offering a minimum tonnage guarantee of castings to an individual or firm that will start a gray iron foundry in that city.

Harrison Steel Castings Co., Attica, Ind., care of J. W. Harrison, will begin work on a plant building estimated to cost about $100,000 within 90 days.

Aluminum Cooking Utensils Co., New Kensington, Pittsburgh, has awarded contract to the Austin Co., Cleveland, for the erection of an aluminum foundry at Oakland, Calif.

James Leffel & Co., Springfield, O., recently installed considerable new equipment in the foundry. The new material included mechanical pouring equipment and molding machines.

Duncan Foundry & Machine Works, 102 West Seventh street, Alton, Ill., is installing an electric furnace and other equipment. William M. Duncan is president and manager.

During the month of February, there were no lost time accidents at the plant of the Sivyer Steel Casting Co., Milwaukee. The company operated 26 working days.

Bedford Foundry & Machine Co., Bedford, Ind., recently was awarded two large contracts covering quarrying machinery and have begun work on the projects.

Cole Mfg. Co., 3218 South Western avenue, Chicago, and the Southern Stove Works, Evansville, Ind., are considering sites for a large stove foundry at Chattanooga, Tenn.

Price-Pfister Brass Mfg. Co. Inc., 2923 Humboldt street, Los Angeles, has awarded a general contract for a one-story addition costing about $20,000 including equipment. The building will be 60 x 80 feet.

Stroh Steel Hardening Process Co., Westinghouse building, Pittsburgh, contemplates the construction of a heavy castings foundry at Railroad and Twenty-second street, Pittsburgh. W. Y. Stroh is president.

Hasdel Corp., Delphos, O., has been chartered with $75,000 capital by John Luma and Alex Shenk to operate a foundry and machine shop for the manufacture of refrigerator machines, ice cream units and other machinery.

Marion Foundry & Supply Co., Marion, Ind., has been incorporated to manufacture and repair all varieties of gas, oil and waterware supplies by Henry Erlewine and Cecil C. Chamberlin.

National Bronze & Aluminum Foundry Co., Cleveland, has installed a new furnace for the production of its proprietary aluminum alloy. The installation will increase the production greatly and excess alloy will be cast into ingots.

Mississippi Valley Foundry, 705 Park drive, Alton, Ill., recently built a 20 x 30-foot addition to its foundry. The company also has installed an oil-fired melting furnace and a core oven. William Allred is manager.

Montgomery-Laumer Steel Co., Pittsburgh, has been incorporated with $25,000 capital by Lilias Elliott, 1417 Oregon avenue, Steubenville, O., to manufacture and sell metal-working machinery, to cast, forge and fabricate structural steel and metal products.

Milwaukee Die Casting Co., 291 Fourth street, Milwaukee, has purchased a site 380 x 470 feet on Holton street in the north side industrial district. No plant expansion is contemplated at present. H. F. Schrader is vice president of the company.

Calumet Electric Casteel Co., Hammond, Ind., has been incorporated by B. A. Zikmund and George A. Krause to manufacture steel castings. The company will occupy the foundry formerly maintained by the Damascus Steel Castings Co., Summer street. (Noted April 1.)

Morgan Foundry Co., Independence, Mo., a subsidiary of the Clay & Bailey Co., Kansas City, recently has moved into the plant formerly occupied by English Bros. Foundry at Fortieth and Gould streets, Kansas City. The Independence plant has been discontinued.

El Dorado Foundry, Machine & Supply Co., El Dorado, Ark., has been formed by the merger of the El Dorado Foundry & Machine Co. and Ellis Iron Works. The new company will engage in the manufacture and repair of oil well and saw mill machinery, supplies and equipment.

Alton Foundry Co., 506 Pearl street, Alton, Ill., recently built a two-story addition to its foundry, 40 x 80 feet. It also erected a pattern storage, 24 x 40 feet, and a new office building, 15 x 20 feet. F. Stolze is president and manager and A. V. DeGrand is secretary and treasurer.

Jones Hollow Ware Co., Forrest and Eager streets, Baltimore, has taken over the plant formerly occupied by the Levering Bros., York, Pa. The company will continue to manufacture its line of enamel ware and will begin production of a boiler which is a new product. The company expects to be in operation about May 1. G. B. Collins is treasurer of the company.

Swartz Mfg. Co., Freeport, Ill., manufacturer of automotive castings, has been merged with the Stover Mfg. & Engine Co., Freeport. Carl H. Swartz, president and treasurer, becomes a member of the Stover board. Activities of the company will be transferred to the Stover plant and its lines of production will be continued by owners.

Ornamental window spandrels of the 83-story Empire State building now under construction on the old Waldorf-Astoria site in New York will be of aluminum and cast at the Cleveland plant of the United States Aluminum Co. It will take 5704 of the spandrels to equip the building, requiring more than 600,000 pounds of aluminum. This is the largest order for architectural aluminum yet placed, according to A. B. Norton, manager of the Cleveland plant. Work on the order has been started.

The Scott-Witter Steel Corp., Hartford, Conn., has changed its name to the Hartford Electric Steel Corp. New officers recently were elected and include Albert W. Gray, chairman of the board of directors; Edmund S. Gardner, president; George C. Hagstrom, vice president and sales manager; Kenneth P. Applegate, vice president; John E. Lynch, secretary-treasurer and W. F. Chase, office manager.

George H. Smith Steel Casting Co., Milwaukee, will start construction April 15 of the first unit of its new plant at Chase and Holt avenues, on a 20-acre site. The first structure will be 150 x 200 feet and will be occupied by the Trackson Co. unit, manufacturer of crawler attachments and operating equipment for tractors. The remainder of the tract will be used for machine shops, to be erected at intervals, to accommodate this entire branch of activity, leaving the Clinton street plant for castings production exclusively. (Noted Feb. 15.)

New Trade Publications

SPECTROGRAPHIC EQUIPMENT—Adam Hilger Ltd., London, England, recently has published a 40-page pamphlet describing its spectrographic equipment for metallurgical analyses.

STEEL CASTINGS—Nugent Steel Castings Co., Chicago, has issued a pamphlet, 12 x 18 inches, illustrating and describing its facilities. Large illustrations show various parts of the plant.

SAND TESTING EQUIPMENT—Harry W. Dietert, Box 1506, Detroit, has issued several additional leaves to his folder on foundry sand testing equipment. The additions describe the manipulation of several new pieces of apparatus including an instrument for determining the sintering point of sand.

CLEANING MACHINERY — Ideal Industrial Machinery division of the C. M. Corp., Winton place, Cincinnati, has published a booklet illustrating and describing the various types of tumbling, cleaning, loading and mixing machinery that it manufactures. The booklet also includes information on the air blast drier and chip separator that it makes.

SPEED REDUCERS—W. A. Jones Foundry & Machine Co., Chicago, has published a catalog of the herringbone speed reducers that it manufactures. The booklet gives a general description of the line of gears that the company makes, explains the advantages, shows the various designed teeth that are used, how they are cut, etc. The majority of the booklet is devoted to tables of horsepower of various gear ratios. The last section of the catalog is replete with illustrations of typical installations.

ELECTRIC FURNACES—General Electric Co., Schenectady, N. Y., has issued a 20-page catalog on the uses of its electric furnaces in industry. Annealing furnaces for steel castings, alloy steel and aluminum castings are described together with furnaces for cyaniding, hardening, heat treating, copper brazing, sherardizing and vitreous enameling. The company also has issued two folders on its cartridge-type electric heating units and on its strip heaters.